AN AUTOSEGMENTAL APPROACH TO PHONOLOGICAL PHENOMENA IN SHILLUK

by Leoma G. Gilley

Thesis submitted for the degree of
Doctor of Philosophy
at
The School of Oriental and African Studies
University of London
August 1988

An Autosegmental Approach to Phonological Phenomena in Shilluk

Leoma G. Gilley

Abstract

Shilluk is a Western Nilotic language spoken in southern Sudan. Previous works on this language have failed to adequately capture the phonological and morphological systems of the language. An Autosegmental approach employed within a framework based upon the tenets of Lexical Phonology, allows the various aspects of Shilluk phonology to be separated in an insightful way. Thus, the vowel and consonant harmony systems, the tonal system, and the syllable structure may be dealt with independently. The thesis comprises six chapters: 1. Introduction, 2. Phonetics and Phonology, 3. The Representation of Lexical Items, 4. Syllable Structure, 5. Lexical Levels of Derivation, and 6. Summary.

Chapter 2 provides a relatively 'autonomous' account of the consonants, vowels (including length), and tone. Chapter 3 presents evidence for the claim that it is necessary to set up independent underlying representations for the stems of singular and plural nouns, as well as for Transitive verb forms. Issues covered in this chapter are tone and the harmony systems — vowel harmony, vowel and consonant harmony, and consonant harmony. Chapter Four completes the argument for independent representations with a discussion of syllable structure. This chapter shows how syllable structure constraints may be invoked to account for surface vowel length alternations. In turn, this chapter adds another argument for the claim that most lexical items require dual (independent) underlying representations. The material in this chapter demonstrates that processes motivated by syllable structure make it the most influential factor in Shilluk phonology. In Chapter 5, the discussion turns to the ordering of levels within the Lexicon. By combining all the tone and syllable structure rules, it is possible to establish the presence of three levels within the Lexicon. A summary of all the rules developed in the thesis are given in the sixth chapter along with comments on the implications of this study with regard to language acquisition. Some suggestions are also made for further study.

Acknowledgements

When I agreed in 1983 to investigate why the Shilluk people were having trouble reading their own language, I innocently believed reports that this was "an easy language." Little did I know that I was embarking on the adventure of a lifetime.

The reputation of the Shilluk language, or more accurately, Nilotic languages, has been around since at least 742 B.C. as evidenced by this quote from the Old Testament:

> "...Go, swift messengers, to a people tall and smooth-skinned, to a people feared far and wide, an aggressive nation of strange speech, whose land is divided by rivers " (Isaiah 18:2 NIV).

Isaiah is as accurate now as he was then.

During the three years I have spent in the Sudan studying Shilluk, enduring the heat, avoiding the civil war, and learning to admire and love these amazing people, I have been stretched, challenged, changed. I am grateful for the time spent in the Sudan, and hope that my relationship with the Cɔllɔ has only just begun.

None of my efforts would have come to fulfillment without the support given by the Sudan Branch of the Summer Institute of Linguistics and Sr. Mary Theresa Nyathow. Sr. Theresa made it possible for me to continue learning the language after I was evacuated from the Shilluk area. She has not only taught me and been my friend, but she has introduced me to many other willing teachers. I marvel at the patience shown by Gabriel Gwang, Mark Othɔw, Henry Omai and Thabɔ as they repeated words, explained meanings and whistled tones. Many thanks go to Peter Obwunyɔ for the many hours spent working out details of tones and verbs and nouns.

Thanks also go to Mary Ruth Wise and Cyndy Miller for encouraging me to go to London to study. I guess they saw that I was hitting my head against a wall that would not fall down without additional help.

Special thanks are due to Mission to the World who supplied a large portion of the funds needed to complete this program of study.

The primary responsibility for bringing coherence and order out of the chaos of data has rested with my supervisor, Dick Hayward. I found more comfort than he did in the realization that he did not understand this language either. However, thanks to his patient questioning, prodding, and theorizing, it began to make sense. I appreciate his attention to detail and his knowledge of phonology. If I have become a 'linguist', it is through Dick's direction, guidance, and encouragement. Although neither of us would willingly start over again 'from scratch' on Shilluk, we would agree that we have been positively challenged and stretched through our contact with this language.

Michael Mann and Rick Brown contributed their expertise with computers. Michael spent considerable time figuring out programs to sort my data. Rick designed the print table so that I could write down my findings.

Without Dave Crozier's suggestion for printing and Lorna Priest's hard work, this thesis would probably still be in the production stage three months from now. The 'Global Staff' on the SIL course have consistently encouraged me to keep on. Special thanks to those who read through chapters and told me it was worth writing, especially Gloria Kendall. Throughout this endeavor, friends have given moral support and encouragement. I owe special thanks to Alemayehu Haile for the many good suggestions

and times of discussion. I also particularly appreciate Janice Ratcliffe, Regina Blass, Margaret Hill, the All Souls' Choir and Fellowship Groups for their part in keeping me in one piece. I am grateful to Cameron Duncan and Inka Pekkanen for working so diligently to make the Phonetics course a success and for allowing me to delegate so much responsibility to them.

Finally, I thank my parents who have always wanted the best for me, and have encouraged me to be the best that I could be.

This thesis is dedicated to the Shepherd through whom ALL things are possible.

TABLE OF CONTENTS

Abbreviations and Symbols

Phonology

AC = Associating Conventions
A/Api = Apical
ASL = Alternatingly Short and Long Vowels
ATR = Advanced Tongue Root
BEC = Bracket Erasure Convention
ben = Benefactive Marker
Bk = Back
C/Cons = Consonant
CCl = Central Closure
cm = Complement Marker
Co = Coda
Cor = Coronal
CR = Complement Rule
DF = Distinctive Feature
DR = Default Rule
[Ex] = Expanded Pharynx
[F] = Feature
FBU = Feature Bearing Unit
H,M,L = High, Mid, Low Tone
Hi = High
!H = Downstepped High
IIP = I-Incorporation Process
IL = Invariably Long Vowel
inst = Instrument Marker
IS = Invariably Short Vowel
Lab = Labial
Lo = Low
LT = Laryngeal Tier
map = mapping
N = Nucleus
Nas = Nasal
O = Onset
Occ = Occlusive
OCP = Obligatory Contour Principle
Pal = Palatal
R = Rime
r = rare
Rd = Round
rt = root

SD = Structural Description
SF = Surface Form
SLT = Supralaryngeal Tier
Son = Sonorant
st = stem
T = Tone
TA = Tone Assignment
TBU = Tone Bearing Unit
tns = tense
V = Vowel
[VF] = Vowel Features
Vib = Vibrant
Voc = Vocalic
Voi = Voice
UR = Underlying Representation
WFC = Well-formedness Condition
X' = unsyllabified X slot
μ = morpheme
φ = Phonological
θ = stem
σ = syllable head
w = word boundary

Grammar

A = Agent
Act = Active Voice
App = Applicative
B = Benefactive
Cm = Complement
C-ob = Obligatory Complement
C-opt = Optional Complement
Coll = Collective
Hab = Habitual
I/inst = Instrument
indef = indefinite
infl = inflection
Intran = Intransitive
Loc = Location
n = Noun
N-Cm = Non-Complement
Nm/nm = Number Suffix
NP = Noun Phrase
P = Patient
Pass = Passive Voice
Pfx = Prefix
Pl/pl = Plural

Ps/ps = Possession Marker
Psd = Possessed
Psr = Possessor
pst = past tense
Qual = Qualitative
rd = Referential Determiner
S = Subject
Sfx = Suffix
Sg = Singular
Sglt = Singulative
sp = spreading
SVCm = Subject, Verb, Complement
Vb = Verb
wd = word
X = any filler
1ps = first person singular
1pp = first person plural
3pp = third person plural

General

NIV = New International Version
SIL = Summer Institute of Linguistics
SPE = Sound Pattern of English
SPR = Structure of Phonological Representations

CHAPTER ONE

INTRODUCTION

1.0 Introduction to Shilluk

The Shilluk language is spoken by an estimated one million people in southern Sudan. The people call themselves *cɔ̀llɔ̀* and the language *ɖɔ́cɔ̀llɔ̀*. The word 'Shilluk' is an Arabic version of *cɔ̀llɔ̀*.

Shilluk is a Nilotic language. A recent classification by Persson (1984) has categorized it as follows:

Chari Nile
Eastern Sudanic
Nilotic Languages
Northern Nilotic
North-western Group
Lwoian languages
Lwo group
Northern Lwo sub-group
Shilluk

Other languages in the Northern Lwo sub-group include Jur Luwo, Belanda Bor, Shatt (or Thuri), Anuak, and Lokoro (or Pari).

The Shilluk consider their borders to extend from Renk in the north to Tonga in the west to Doleib Hill in the south east. Their villages are concentrated along the Nile River in the vicinity of Malakal.

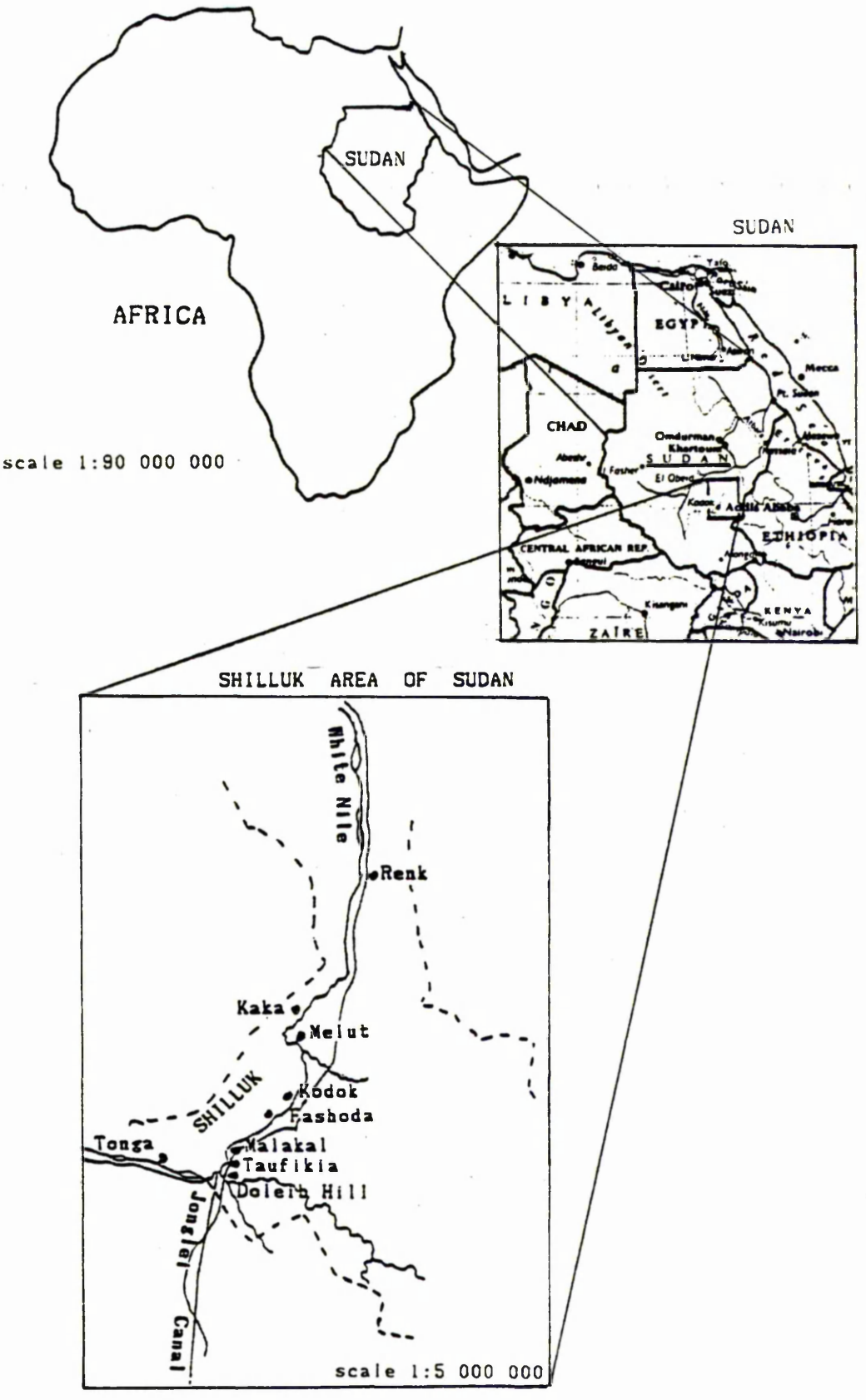
There are two major Shilluk dialects spoken: *gaar* in the north and *lwak* in the south around Doleib Hill. The 'purest' Shilluk is said to be spoken around Pachoda where the *rat* 'king' and his court are located. The data in this thesis have been collected from individuals originally from the area near Pachoda.

1.1 Previous Studies of the Shilluk Language

Shilluk has been the subject of documented linguistic investigation since the early 1900's. Westermann (1912) described the sounds of the language in some detail. He included descriptions of syntactic aspects of the language. In his book there are also a large number of texts, with English translations, which range over a wide variety of topics.

Kohnen (1933), after some thirty years of study, published his *Shilluk Grammar*. The aim of that work was to facilitate language learning for foreigners. Kohnen followed the orthographic suggestions of the Rejaf Conference (1928) and made no attempt to describe the phonology other than to give a pronunciation guide.

In 1937, Heasty published his *English-Shilluk, Shilluk-English Dictionary*. Again, no analysis was attempted. However, he did include reference to features of vowel length


SUDAN
AFRICA
scale 1:90 000 000
SUDAN
LIBYA
EGYPT
CHAD
SUDAN
ETHIOPIA
CENTRAL AFRICAN REP.
KENYA
ZAIRE
SHILLUK AREA OF SUDAN
White Nile
Renk
Kaka
Melut
Kodok
Fashoda
SHILLUK
Tonga
Malakal
Taufikia
Doleib Hill
Jonglei
Canal
scale 1:5 000 000

and 'breathiness' in the pronunciation section, although neither length nor 'breathiness' is reflected in the orthography.

Tucker (1955) compiled a paper on the verbs of Shilluk. Both vowel length and 'breathiness' are indicated in the data described. A further work by Tucker and Bryan (1966) compared the various Nilotic languages in east Africa. The information contained is of a descriptive rather than an historical comparative nature.

These works have described various aspects of the Shilluk language in some detail. None of them, however, has attempted to analyze the phonology. My goal for this thesis is to attempt to do just that.

In order to accomplish this goal, I have used a primarily non-linear approach in conjunction with Lexical Phonology as it has been developed by Kiparsky (1982) and Mohanan (1982). However, different theoretical models approach a problem or a language from different perspectives since they each ask different questions. In order to take advantage of the strong points of certain models, I have used a somewhat eclectic approach to my analysis of Shilluk. In the course of the thesis, I make use of the models of Phonemics, Generative Phonology (of the *'Sound Pattern of English* variety'), Non-linear and Lexical Phonology as well as the theory of Underspecification. Each of these approaches adds a different facet of insight into our understanding of the hitherto unanalyzed phonology of this language.

1.2 Theoretical Models

1.2.1 Phonemics

Since Shilluk phonology has not been formally analyzed, it is not possible to come to it with any *a priori* assumptions. I begin with the raw phonetic data. Phonemics provides a technique for processing this phonetic data and discovering certain facts about the pertinent units of sound (Pike, 1947). According to Pike, the goal is for the 'outsider' to arrive at an analysis which mirrors the perceptions of the native speaker.

One of the practical outworkings of Phonemics is the development of an orthography. According to Pike (1947), sounds which are phonemically distinct will be more easily distinguished by the native speakers than will phonetic variants of a phoneme.

Several orthographies have been devised for Shilluk using the basic premises of phonemics. The fact that the Shilluks themselves have not been very successful in learning to read and write with any of these suggests that the autonomous phoneme might not be an adequate analytical unit in this language.

An illustration of one of the problems would prove helpful at this point. Vowel length is contrastive, as can be seen from these minimal pairs:

(1) [gɔ̀l] 'large hooks'
(2) [gɔ̀:l] 'wild dogs'

However, if we look at the next set of words, length seems to be of a more 'variable' nature.

(3)	[gɔ̀l]	'large hooks'	[gɔ̀l:é]	'his large hooks'
(4)	[gɔ̀:l]	'wild dogs'	[gɔ̀l:é]	'his wild dogs'

or

(5)	[wą̂t]	'son'	[wą̂:dē]	'his son'
(6)	[wą̂:t]	'sons'	[wą̂t:é]	'his sons'

The issue is quite complex. It is apparent that an account of vowel length cannot be decided on the basis of an examination of one form of a word. Lexical and morphosyntactic determinants must be taken into account. This suggests that an analysis operating with deep — as well as surface — structures might be more insightful and agree better with the mental categorization of native-speakers. We turn, then, to a Generative approach.

1.2.2 Generative Phonology

The usual starting point for Generative Phonology is the theory presented in Chomsky and Halle's *The Sound Pattern of English* (SPE: Chomsky and Halle, 1968). In this work they introduce the ideas of underlying versus surface representations and a series of extrinsically ordered rules to derive the latter from the former. The concept of Distinctive Features was adopted from Jakobson and incorporated — with some modifications — into the theory. By using distinctive features, they were able to capture significant generalizations. The principles of simplicity and economy were enhanced by the use of distinctive features such that the more significant the generalization, the simpler the notation.

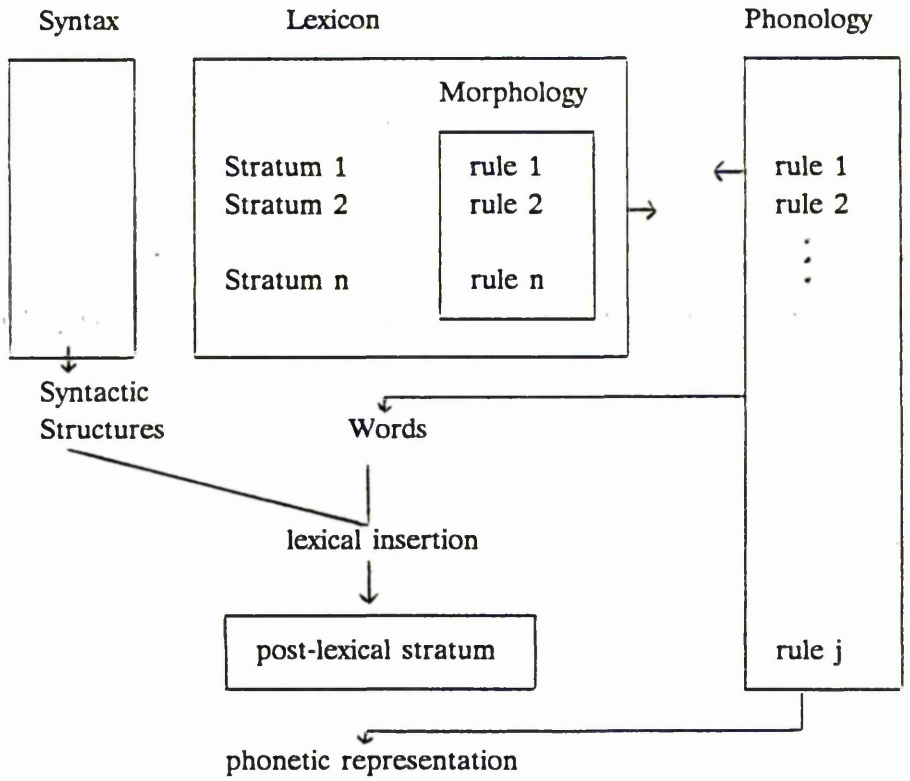
As is pointed out by van der Hulst and Smith (1985:3), there are two aspects to the theory proposed in SPE: derivational and representational. Both of these aspects have undergone significant changes in recent years. Lexical phonology has offered changes to the derivational aspect of the theory. The various Non-linear approaches have extended the representational aspect of the generative theory. Moreover, the more recently developed Underspecification Theory may be made to function within a Non-linear model. The contribution that Archangeli (1984) has made to the theory concerns the principal governed selection of features which are considered to be present in the classificatory Distinctive Feature matrix and the massive use of redundancy rules to specify values in that matrix. We will look in turn at Lexical Phonology, Non-linear Phonology, and Underspecification Theory.

1.2.2.1 Lexical Phonology

The development of Lexical Phonology grew out of papers by Pesetsky (1978) and Siegel (1974). Pesetsky's analysis of Russian argued that cyclic rules apply in the lexical component after the word formation rule applications. Earlier, Siegel had proposed block or level ordering with phonological rules applying between these blocks. Mohanan (1982) and Kiparsky (1982) expanded these ideas into what is now known as Lexical Phonology.

While the various conceptions of the model differ somewhat, the common idea is to have both "lexical and postlexical applications of phonological rules" (Mohanan, 1986:5). Lexical Phonology strives to capture the important relationship between morphology and phonology in terms of a set of levels. I include Mohanan's diagram of the model (1982:11) in (7).

(7)



Within the Lexical Phonology model, underived lexical items are seen to enter the first level and are subject to the morphological rules of that level. At the end of that level, certain lexical phonological rules apply to the structure if it meets the proper description. The structure then passes through the next level and follows the same pattern. At the end of the Lexical Level, the words are inserted into the syntax where they may undergo Post-lexical phonological rules. Post-lexical rules have to apply without exception and have no access to lexical information.

The number of levels and the rules those levels contain seem to be language specific. English is said to have five morphological domains including the Post-lexical Level according to Mohanan (1985). Instead of the '+' or '#' junctural boundary diacritics used in SPE for indicating morphological levels, the formalism in Lexical Phonology is restricted to bracketing. The various levels are shown by the placement of brackets as shown here.

(8) un + happy + ness = [[un[happy]]ness]

1.2.2.1.1 Bracket Erasure Convention

At each lexical stratum, phonological rules have access to morphological information. However, if rules are allowed to apply cyclically during the lexical derivation, the results would often prove incorrect. In order to restrict cyclic application of rules, Bracket Erasure was proposed.

Originally, Chomsky and Halle (SPE,1968) incorporated Bracket Erasure as a part of the definition of cyclic rule application. Later, Pesetsky suggested that the Bracket Erasure Convention (BEC) should be ordered at the end of every cycle. Mohanan

(1982) and Kiparsky (1982) argued that the BEC should apply only at the end of a lexical stratum. Cole (1987) presents arguments from English derivational suffixes and from the languages Seri, Ci-Ruri, and Sekani that rule out the possibility that the BEC applies cyclically. In her discussion of English, Cole claims that in order to correctly constrain combinations of suffixes in English, it is necessary to distinguish derived stems from non-derived ones. If the stratum-final or cyclic version of the BEC is implemented, then the analysis cannot succeed.

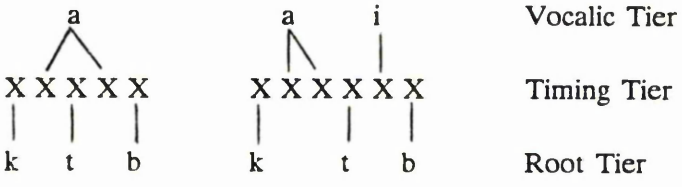
In the case of Seri, /k/ epenthesis occurs in a coronal-m sequence under two conditions: i) a morpheme must precede the mood prefix with the coronal consonant, and ii) the /m/ must be part of a prefix (p.189). In order to meet the (ii) condition, the brackets identifying the root must be present when /k/-epenthesis applies. If a cyclic application of the BEC were implemented, then the root brackets would have been deleted already. Further, since the root often belongs to a different stratum, even the stratum-final application of the BEC will eliminate the necessary bracketing before /k/-epenthesis applies. She concludes, then, that "the BEC neither applies at the end of every lexical stratum, nor at the end of every cycle" (p.186). Instead, Cole proposes that the BEC may apply once "after all morphological operations have taken place" (p.203). Further, Cole suggests that the formal mechanism which erases the brackets is Plane Conflation. Plane Conflation, then, is assumed to occur before the Post-lexical Module or Level unless specifically stated otherwise. Thus, all morphological information has been erased by the time the Post-lexical module[1] is reached.

1.2.2.1.2 Morpheme Planes

Another aspect of Lexical Phonology has to do with the representation of the morphemes. Concatenative languages have been traditionally viewed as having strings of morphemes which are either free-standing or bound (i.e., affixes). However, non-concatenative languages such as Arabic, do not lend themselves to such a straightforward analysis. Often in non-concatenative languages, the segments which relate to one morpheme are interspersed with segments from another morpheme. These morphemes are represented on separate tiers or planes[2]. Often, the identity of the morpheme relates to a particular canonical pattern (McCarthy 1982:191ff). The canonical pattern tier is referred to by McCarthy as the prosodic template. Other sorts of templates are syllables, metrical feet or even combinations of units from different levels. All tiers are mapped onto the timing tier by means of association rules discussed in Section 1.2.2.2.

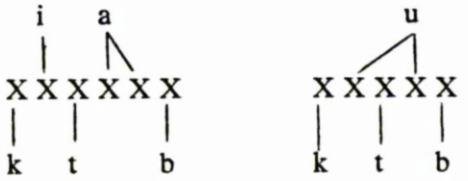
Examples from Sudanese Arabic show four of the possible templates for the root /k t b/ 'to write.'

(9)



[katab] 'he wrote' [ka:tib] 'he writes'

(10)



[kita:b] 'book' [kutub] 'books'

In each case, the root tier is composed of /k/, /t/ and /b/. The vocalic tier, however is interspersed within the root. Since the consonant and vocalic tiers are regarded as independent, either one can be varied apart from the other.

McCarthy (1982:192) suggests that the canonical pattern of the morphemes could also be considered a tier in its own right. This tier would specify the number and distribution of the morphemes for a particular form.

1.2.2.1.3 Application

From the perspective of Lexical Phonology, then, we see a principled interaction between the morphology and the phonology. Formal acknowledgement of this interaction has helped to resolve some classic problems of analysis in languages like English (Mohanan, 1985) and Polish (Rubach, 1985; and Booij and Rubach, 1987). We will see that certain problems in Shilluk phonology can also be successfully resolved by applying Lexical Phonology.

One fundamental question that arises from the analysis of Shilluk presented in this thesis is, What forms are actually derivable? It is generally assumed for most languages that plurals are derived from singulars and that the various verb forms of a single verb paradigm are also derived from a single source; i.e., there is an assumption of 'morpheme invariance.' The data from Shilluk pose some strong evidence that in this language, two independent representations are needed for each lexical item of the two major categories of nouns and verbs. In other words, independent representations are needed for both singular and plural nouns and for two forms of Transitive verbs.

The result of this claim is that twice as much information must be coded into the Lexicon as has generally been assumed. The resulting expansion in the mechanisms for relating such forms and the memory load required will certainly have implications for our understanding of child language acquisition.

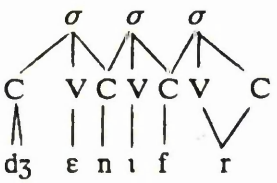
1.2.2.2 Non-linear Phonology

1.2.2.2.1 Syllable Structure

In 1976, Kahn introduced the idea of representing the syllable on a separate tier. He linked the nodes of the syllable to the segments by means of association lines of the type used in autosegmental phonology. The value of such a configuration was readily apparent. However, much debate has been generated over the nature of the structure and representation of it.

Clements and Keyser (1983:7ff) suggests that a third tier be introduced which distinguished between syllable peaks and non-peaks or margins. He calls this intermediate stage the CV-tier.

(11)

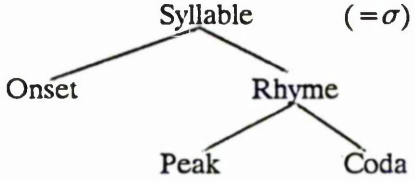


Levin (1983) substitutes X's for C's and V's. Given that the syllable structure defines the nuclear and marginal positions, it is redundant to also specify C and V slots. The C's will fill marginal positions (in most cases) and the V's will fill nuclear slots.

Kuriłowicz (1971) proposed that the peak and the coda be grouped into a constituent. He suggested that this grouping is a universal of syllable composition.

Selkirk (1982) divides the syllable into onset and rhyme (or rime). She points out that while there are numerous phonotactic constraints within the onset or within peak and coda, there are no restrictions (at least for English) involving onset and peak. The basic composition of a syllable consists of a template and a set of collocational restrictions. The representation in (12) demonstrates the syllable structure proposed (p.341). Selkirk's 'Peak' will be equated with Nucleus in this thesis (see (12)).

(12)



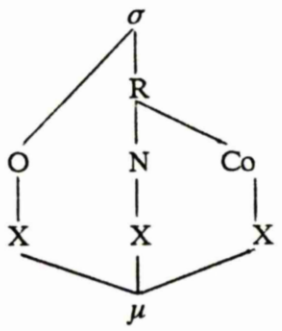
Noske (1982:259) assumes that the onset-rime bipartition is a universal of syllable structure. In addition, he claims that syllabification does not take place at the underlying level. Instead, he demonstrates that, at least for French, syllabification applies after at least one phonological rule. Syllabification is also seen to be perseverative (p.274) so that as the structure changes during the course of the derivation, the syllabification process interacts with that structure to insure that only forms which conform to the syllable template are allowed to surface.

Also, following McCarthy and Levin it is assumed in this thesis that Underlying Representations are only partially syllabified. Specifically, only the vowel, or syllable head, is indicated.

Throughout the thesis, the following notation will be used. An 'X' represents a timing slot on the timing tier. A syllable head is shown as a vertical line over the appropriate X slot.

The Onset (⟋) and Coda (⟍) of the syllable will be filled in during the syllabification process. The syllable head is indicated by a *sigma* (σ). A morpheme is shown as a *mu* (μ). [F] will indicate either a single feature or group of features, the specifics of which are not particularly relevant to the discussion.

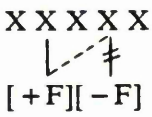
(13)



The Onset and Rime branch first. The Rime may then divide into the Nucleus and the Coda.

Delinking of an autosegment is shown as (≠) and linking as a broken line (- - - -).

(14)



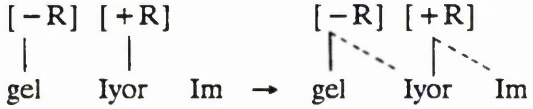
1.2.2.2.2 Representation

Non-linear phonology deals with the representational side of Generative Phonology. In the SPE model, suprasegmental features and segmental features were all placed in the same feature matrix. All were treated equally as segmental features. This solution proved very unsatisfactory especially in trying to account for tone and vowel harmony.

Goldsmith (1976) argued for a separation of features onto tiers. He suggested a tonal tier which is distinct from, but associated to a segmental tier. That idea was soon applied not only to tone, but to many other phenomena as well.

Poser (1982:126) discussed the features [Round] and [Back] as autosegments in order to account for the vowel and consonant harmony systems in Turkish. For example, he posits the following analysis for the word [geliyorum] 'I am coming.'

(15)



[geliyorum]

The autosegmentalized feature [Round] is attached to the Feature Bearing Unit (a vowel in this case), and allowed to spread until blocked by another occurence of the same feature, but with an opposite value ([+Round], in this case.)

Clements and Sezer (1982) also applied a similar autosegmental treatment to harmony in Turkish. Additionally, they introduced the idea of 'opaque' segments. Opaque segments appear, on the surface, to be exceptions to the regular spreading process. Opaque segments are lexically assigned. The Turkish example is continued with the rule given by Clements and Sezer (p.218).

(16) Roundness Harmony

P-segments: [+round] [−round]
Opaque segments: [+syllabic, −high]

Non-high vowels are not involved in the roundness system. They are opaque to the roundness harmony. Another example involving opaque segments is found in Laughren (1984) and Kisseberth (1984) where depressor consonants are said to function as opaque elements with regard to tone spreading. These consonants effectively block the further spreading of tone.

In Vata, there are two sets of vowels. In one set the tongue root is advanced and in the other it is retracted.

(17)

Advanced		Retracted	
i	u	ɪ	ʊ
e	o	ɛ	ɔ
ʌ		a	

The harmonic domain is the morpheme. This means that the [ATR] harmony cannot cross a morpheme boundary. All vowels, then, within a given morpheme must be from the same set.

Kaye (1982) analyzes the feature [ATR] autosegmentally. The [ATR] autosegment is shown as [*a*A]. The representation given by Kaye is shown in (18).

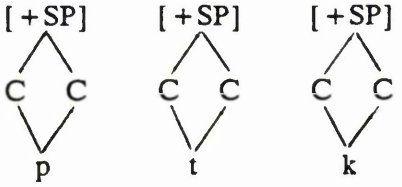
(18)

	retracted	advanced
autosegmental tier		+A
segmental tier	gOlU	bIdO
	[gɔlʊ] 'dugout'	[bido] 'wash'

Poser (1982:129) also demonstrated how the feature [Nasal] is autosegmentalized to explain the nasal harmony in Guaraní. Voiceless obstruents are transparent to the harmony. 'Transparency' means that that segment does not participate in the process. Poser explains that the triggers for nasal harmony are the stressed vowels (both oral and nasal) and nasal stops. These segments are specified for nasality underlyingly. The remaining segments (targets) receive their nasal specifications from the triggers.

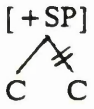
Another example of an autosegmental tier comes from Hermans (1985), who posits separate tiers for the Laryngeal and Supralaryngeal features in his analysis of pre-aspiration in Icelandic. The feature [Spread glottis] ([SP]) represents the aspiration element and it is argued that it has independent, autosegmental status. The tiers involved, then, are the supralaryngeal (segmental features) and the laryngeal ([SP]). Hermans represents the aspirated voiceless stops as in (19).

(19)



Given this framework, the following Deaspiration Rule was proposed for Icelandic.

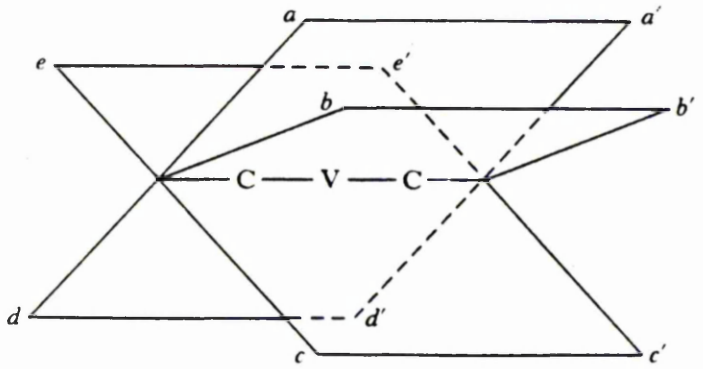
(20) Icelandic Deaspiration



The [+SP] is delinked from the second half of the geminate.

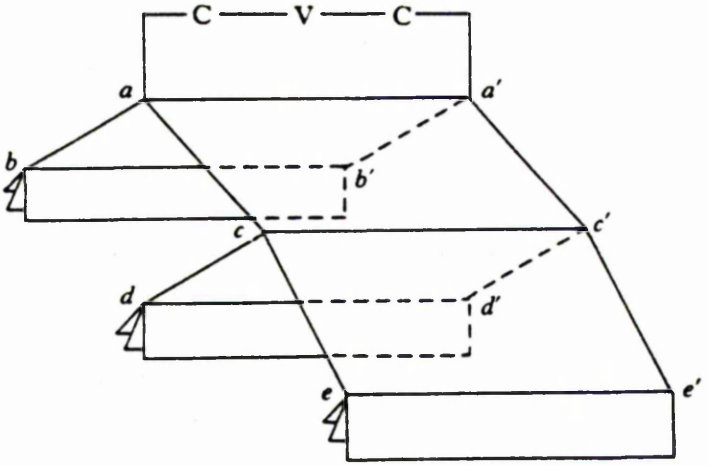
One could go on and on, but the point is that any number of features can be autosegmentalized. With such a wide array of possible autosegments, each with its own tier or plane, it is essential to organize them into a conceptual unit. Clements (1985) suggests two models. The first model is shown as a multi-tiered structure in which each feature is assigned to its own tier. All the features or tiers are linked to a common core or 'skeleton.' Clements represents the core with C's and V's. Clements' representational geometry (1985:227) is shown below in (21).

(21)



An alternative model, also proposed in Clements' article (1985:229) posits a more complex construction. Again, the CV tier is the core. This model, shown in (22), attempts to capture the componential nature of speech production. Some gestures are more independent than others. For example, laryngeal configuration has the highest degree of independence. The degree of nasal cavity stricture, degree and type of oral cavity stricture and the pairing up of active and passive articulators are cited as showing some degree of mutual independence. One of the values claimed for such a model is that it offers an explanation for assimilation processes.

(22)



The upper edges represent class tiers: the root tier *(aa')*, laryngeal tier *(bb')*, supralaryngeal tier *(cc')*, 'manner' tier *(dd')*, and 'place' tier *(ee')*. The lower edges are the feature tiers. There could also be a tonal tier.

Cole (1987:18) claims that there is no longer a typological distinction between features involved in spreading or delinking rules in the phonology and those which are not. She argues that the term 'autosegment' is no longer appropriate since all features can be seen as autosegmental. These autosegments can link to or delink from the skeletal tier without reference to any other Distinctive Feature. The features, then, are seen as independent autosegments. It will be assumed in this thesis that all features are in principle autosegmental.

In order to define the limits for associating the core with the features or autosegments, Goldsmith (1976) proposed the Well-formedness Condition (WFC). A generalized version of the WFC is given in (23).

(23) Well-formedness Condition

1) All Feature Bearing Units (FBU) are associated to at least one feature.
2) All features are associated to at least one FBU.
3) Association lines do not cross.

The WFC developed for the autosegmental model applies equally well to the multi-dimensional model described here.

Some features, such as tone or [ATR], will normally attach to a vowel. Other features such as [Labial] or [Coronal] will usually associate to consonants. In some cases, a feature such as [Nasal] may apply to vowels and consonants. It is necessary to define the Feature Bearing Unit (FBU) for each autosegment.

The way in which features are associated to the timing tier was originally proposed by Goldsmith (1976). Haraguchi (1977:331) claimed that only one association line needed to be drawn for language-particular tone rules. All other associations would be made by Universal Association Conventions. A generalized version of Goldsmith's Association Conventions is shown in (24).

(24) Associating Conventions

a. Mapping

Insert association lines between one feature and one FBU.

b. Dumping

Left over features are associated to the nearest FBU.

c. Spreading

Left over FBU's are associated to the nearest feature.

The Association Conventions do not specify where to draw the association lines. This decision is language-particular. Therefore, one of the questions raised by the Shilluk data is, Where is the first association line drawn? It will be shown that in that case, the initial association must be made to the 'root'.

1.2.2.3 Underspecification Theory

One of the principles developed in SPE was that phonological rules operate on fully specified Distinctive Feature matrices. In contrast to this view, Underspecification Theory, as developed by Pulleyblank (1983, 1986) and Archangeli (1984), operates with the premise that there are as few feature specifications in the lexical representation as possible. In order to acheive this goal, two principles are suggested. First, according to the Feature Minimalization Principle, one should use the smallest number of Distinctive Features necessary to keep the phonemes distinct. Secondly, all possible redundancies should be removed from the feature specification.

One means of removing redundancies is to select one value (either '+' or '−') for a particular feature which would be specified in lexical representations. The choice of the value selected would be determined by language-specific factors and universal considerations of markedness. The only requirement for underlying phonemes is that they are distinct. It is often the case, then, that one phoneme in each major subsystem (i.e., vowels and consonants) may be represented as prosodic functions without any feature specification at all.

In 'classical' Generative Phonology, it was assumed that the redundant feature values which had been omitted from the lexical representation had to be supplied before any phonological rules were applied. In other words, the matrices for all segments had to be complete at the beginning of the phonological component. By contrast, Underspecification Theory proposes that redundancy rules should apply as late as possible.

If this application of redundancy rules were left unconstrained, then a ternary rather than a binary feature system would become possible (i.e., '+', '−', 'ø'). The approach is constrained, however, by the convention that a default rule must assign [αF] before any rule referring to [αF] in the structural description. Therefore, when a phonological rule refers to a feature that was previously unspecified, then the rules supplying that default value must be ordered prior to that phonological rule.

There are three types of redundancy rules: *default* rules, *complement* rules, and *learned* rules. *Default* rules are context-sensitive and are assumed to belong to Universal Grammar. A typical example would be:

(25) [ ] → [−Hi] / [____, +Low]

A *Complement* rule supplies the opposite or complementary value to the one selected for specification in the lexical representation. If, for a particular language, one or more of the vocalic segments were lexically marked as [−Hi], the opposite value would be assigned to the remaining vocalic segments by means of a Complement Rule such as (26).

(26) [ ] → [+Hi]

The use of Default Rules and Complement Rules is shown below in an example from the Japanese vowel system. Japanese has five vowels /i,e,a,o,u/ that may be represented by the following matrix.

(27)

	i	e	a	o	u
High	−			−	
Low			+		
Back				+	+

The rules needed to complete the matrix are as follows:

(28)

[ ] → [−Hi]/ [____, +Low]	DR
[ ] → [+Hi]	CR
[ ] → [−Low]	CR
[ ] → [+Bk, −Rd]/[____, +Low]	DR
[ ] → [−Bk]	CR
[ ] → [*a*Rd]/[____, −Low,*a*Bk]	DR

If the rules supplied by Universal Grammar are suspended in some language-specific case, then a *Learned* Rule would have to be given. Learned rules would cover a segment that has features such as [+Hi, −Bk, +Rd]. The Learned rule would be like the one in (29).

(29) $[\ ] \rightarrow [+\text{Rd}] \,/\, \underline{\qquad\qquad}$ over $\begin{bmatrix} -\text{Bk} \\ +\text{Hi} \end{bmatrix}$

As was mentioned earlier, it is possible to allow one vowel and one consonant to have no feature specifications lexically. This maximally underspecified segment or non-specified segment is determined solely on the phonological patterns of the language. Often an epenthetic element is considered the best candidate for the non-specified segment. Since that element's function is to make up for deficiencies in the prosodic structure, and it is not present underlyingly, then its feature specification would be

supplied by rules. Further, if an element is often subject to assimilation, it might be a good choice for the non-specified segment. Ultimately, the non-specified segment would be the *default realization* in which all phonic content is supplied by redundancy rules.

One of the advantages of Underspecification Theory is seen in the process of assimilation. If all features are specified, then the assimilation process would involve changing features. Using Underspecification Theory, the process merely fills in a blank matrix.

(30) a. Assimilation b. Spread feature values to unspecified slot

In the first case, the $[-a\mathrm{F}]$ must be delinked from the timing tier. In the second case (b), the features simply spread to an X slot which is not associated with any feature content. Thus, we see that Underspecification Theory demonstrates the close relationship between the way segments are used in the phonological system and the underlying matrix and redundancy rules (Archangeli, 1984:60).

1.3 Overview of the Thesis

In the chapters that follow, I will discuss three major aspects of the phonology of Shilluk. Chapter Two deals with the phonetic data and the phonological rules which apply Post-lexically (see 1.2.2.1), in which a brief Phonemic analysis is presented. Chapter Three consists of a brief account of some grammatical information which establishes necessary morpho-syntactic terminology followed by an examination of the underlying representation for words within the Lexicon. There are obvious similarities between the singular and plural of words as well as between certain pairs of forms found for transitive verbs. However, despite the similarities, the differences of vowels, tones, etc., turn out to be unpredictable. Thus, it will be necessary to posit pairs of independent underlying representations for these forms — which I shall term 'Forms 1' and '2.'

This argument is carried further in Chapter Four. In the discussion of syllable structure, we will see that even the number of syllable elements in the UR of Form 1 may be different from Form 2. It is hypothesized that there are two distinct underlying syllable structures available for roots in the language. One of these structures will account for the Invariably Long vowel words while the other will explain vowels which are long in open syllables, but short in closed syllables. This second syllable structure will also account for the Invariably Short vowel words. The evidence for this hypothesis is examined in some detail.

Chapter Five looks at tone and harmony systems. Having ascertained the various rules which apply to Shilluk phonology, it is then possible to order those rules within the Lexicon. Three lexical strata are posited within the Shilluk Lexicon.

In the concluding chapter, there is a listing of all the relevant rules from previous chapters as they would occur in a derivation. The implications of separate underlying representations are also discussed in relation to child language acquisition.

FOOTNOTES

[1] 'Module' is Mohanan's (1986:7) term. It is used synonymously with 'Level' in this thesis when referring to Lexical Level or Post-lexical Level. There are also 'levels' or 'strata' within the Lexical Level.

[2] 'Plane' and 'tier' are considered synonymous in this thesis.

CHAPTER TWO

PHONETICS, PHONEMICS AND POSTLEXICAL PHONOLOGY

2.0 Introduction

We will now begin our examination of Shilluk phonology. A phonetic transcription of a portion of text is shown below, with both literal and free translations to provide the reader some contextual information.

[– ˉ _ – – ˉ – – – ˉ – – _]
[tʃəŋ[1] akʸɛl ɲimʸa ki ɲiwa akɛɻʰa bəm]
day one sister-my with step-sister-our pst-go Bam
One day, my sister and step sister went to Bam

[ˉ– – _ _ ˉ ˉ – _]
[alɔk kal bʷɷɲɔ bɛ ɲʸɛw kɛ dʒaṃi]
pst-is Kal Bwunyo to buy some things
which is called Kal Bwunyo to buy some things

[– ˇ ˉ – ˉ – ˉ – – ˉ –]
[ki yi ɟo: ařɔ:ɻ gɛn yi̱ ɲʷɔl̤i pa-ani]
and on road pst-attack them by daughters of place-this
On the way, they were attacked by the daughters of this place.

[– ˉ _ _]
[ka gɛ ɲəkʰɔ]
and they fought
And they fought.

[ˉ – – ˉ – – – _]
[kɛ baŋ mɛnani, ŋʸiɲ mɔ gɛn awə̱:ɲ]
and after that, money of them pst-lose
And so, their money was lost.

[– – – ˉ _ – ˉ – _ – ˉ –]
[ka gɛ dɔ:ga paⁱtʃ akɛɻi wɔn ki mɛⁱya]
and they return village pst-go we with mother-my
And they returned to the village and we went with my mother.

[– ˉ _ ˉ – – ˉ]
[ka tʸɛŋ pa-ani pʸɛɕ yi̱ wɔn]
and people place-this ask by us
And the people of this place were asked by us,

[¯ – – – ¯ _ _ _ – ¯]
[kipaŋɔ ařɔ:ʈ oʈɔɳɔ ki yo:]
why pst-attack children on road
Why were our children attacked on the road

[– ¯ _ ¯ – – _]
[o gɛ nu:di̱ tɔ:ŋa paʲɕ]
and they not yet go to village
since they had not yet reached the village?

[– _ _ ¯ ¯ – – _ – ¯]
[ka dʑi: pa-ani ři̱:ŋa wɔ̱k ki lwak]
and people place-this run to outside from barn
And the people of this village ran out from the barn

[– _ _ ⁀]
[ki ɟok ma gi̱:ř]
with men which many
with many men.

[– _ ¯ – ⁀ – ¯ _ ¯]
[dɛ bɷ̃ŋ kʷɔp ma dɔʲʃ ma lwɔp yi̱ gɛn.]
but no talk which good which speak by them
But there was no use talking to them.

[– _ – _ _ ¯]
[gɛ yɔ̱:di̱ bɛʲ tʃaʲ wɔn.]
they begin to blame us
They began to blame us.

This text does not give us the entire phonetic inventory, but it will hopefully provide some impression of the language. A more complete inventory will be given shortly.

We will begin this chapter with the phonetic data of the language. An attempt will be made to 'phonologize' the phones by means of a standard taxonomic approach. We will find that this method offers no explanation for many of the facts at hand.

For a more adequate and systematic account of the data, we will turn to a non-linear approach. The rules given will be post-lexical, and will attempt to account for most of the phonetic data. Our discussion will include the segmental and suprasegmental levels.

2.1 Phonetic Inventory

To begin our discussion of Shilluk phonetics, we turn to the phonetic work chart given below.

Contoids					
Plosives	p	ʈ	t	c	k
	p^h	$ʈ^h$	t^h		k^h
	p^y	$ʈ^y$	t^y		k^y
	p^w	$ʈ^w$	t^w		k^w
	b	ɖ	d	ɟ	g
	b^y	$ɖ^y$	d^y		g^y
	b^w	$ɖ^w$	d^w	$ɟ^w$	g^w
Nasals	m	ɳ	n	ɲ	ŋ
	m^2	ɳ	ɳ	ɲ	ŋ
	m^y			$ɲ^y$	$ŋ^y$
	m^w		n^w	$ɲ^w$	$ŋ^w$
Fricatives	f		ʃ	ç	
	v			ʝ	
Affricates			tʃ	tç	
			$tʃ^h$	$tç^h$	
			$tʃ^y$	$tç^y$	
			$tʃ^w$	$tç^w$	
			dʒ	dʝ	
			$dʒ^y$	$dʝ^y$	
			$dʒ^w$	$dʝ^w$	
Non-Nasal	w		l	y^3	
Sonorants	ʍ		ɭ	ɣ	
			l^y		
			l^w	y^w	
Vibrants			ɾ	$ɾ^4$	
			$ɾ^y$		

Chart 1: Phonetic Contoid Work Chart

Vocoids

	Front				Back								
	Unrounded				Unrounded				Rounded				
High	i	iː	i̱	i̱ː					ɵ	u̱	u̱ː		
					ə				o	oː		ọ	ọː
Low	ɛ	æː	ɛ̱	ɛ̱ː	a	aː		ą̱ː	ɔ	ɔː			

Chart 2: Phonetic Vocoid Work Chart

In order to reduce this rather large inventory to a more manageable size, we will look for examples of contrast in identical or analogous environment. The list below shows the contrastive phonemes of Shilluk.

Contoid Contrasts

		Word	Gloss	(Alternative Pronunciations)
(1)	/b/	bák	garden	
(2)	/c/	cak	to start	[cak, tʃak, tɕak, ʃak, ɕak]
(3)	/d/	dāk	pot	
(4)	/ɖ/	ɖɔ́k	mouth	
(5)	/g/	gɔ̀k	bracelet	
(6)	/ɟ/	ɟak	to rule	[ɟak, dʒak, dʑak]
(7)	/k/	kak	to split	
(8)	/l/	lɛ̀k	pestle	
(9)	/m/	mak	to catch	
(10)	/ɲ/	ɲâŋ	crocodile	
(11)	/ŋ/	ŋān	person	
(12)	/n/	nâm	river	
(13)	/ɳ/	àɳât	type of fish	
(14)	/n/	ànāp	branch of tree	[ànāp, ànāf]
(15)	/ɳ/	tîɳ	small	
(16)	/n/	tin	today	
(17)	/t/	tòŋ	spear	
(18)	/ʈ/	ʈól	rope	
(19)	/p/	puk	soft-shelled turtle	[puk, fuk]
(20)	/b/	buk	to dig	[buk, vuk]
(21)	/ř/	řɛ̀k	necklace	
(22)	/w/	wât	bull	
(23)	/y/	yɛp	to open	

Vocoid Contrasts for [Expanded Pharynx]

	Word [−Ex]	Gloss	Word [+Ex]	Gloss
(24)	bi	to come	bi̯	termite
(25)	kī:	Nile River	kī̯:	falcon
(26)	yɛp	to open	yɛ̯p	tail
(27)	yɛ:yɔ	hair	yɛ̯:jɔ̯	rat
(28)	lʷak	barn	lʷa̯k	pride
(29)	gá:gɔ̄	button	ga̯:gɔ̯	to mock
(30)	ɖɔ̀ŋɔ̀	Juba person	ɖɔ̯̀ŋɔ̯̀	basket
(31)	gɔ́:l	Wild Dog	gɔ̯̂:l	fireplace in barn
(32)	dɔ̀t	tumble bugs	dú̯t	loin cloth
(33)	bɔ̀:ř	heat rash	bù̯:ř	hole

Vocoid Contrasts for Length

	Word	Gloss	Word	Gloss
	Short Vowel		Long Vowel	
(34)	cik	short (pl)	cí:k	discipline
(35)	kîc	orphan	kī̯:c	orphans

(36)	kwɛ́ř	small lizard	kwɛ̋:ř	small hoe
(37)	bʸɛ̰dɔ̰	wrestling match	bʸɛ̰:lɔ́	stalk of millet
(38)	cak	to start	cà:k	milk
(39)	bɑ̰ɲɔ̰	refusal	bɑ̰:ɲɔ̰	grasshopper
(40)	ʈɔ́l	rope	ʈɔ̰:l	ropes
(41)	àkɔ̰c	shorts	àkɔ̰:c	pairs of shorts
(42)	bot	slip on	bò:ř	heat rash
(43)	pʊ̰k	turtle	pʊ̰:k	waterpot

Note that [c]~[tʃ]~[tɕ]~[ɕ]~[ʃ] are all in free variation as are [ɟ]~[dʒ]~[dʑ], [p]~[f], and [b]~[v]. For convenience, we will symbolize the alternatives above simply as /c/, /j/, /p/, and /b/ respectively.

2.1.1 High Glides

The [ʸ], [ʷ] could be interpreted as either a palatalized or labialized consonant or a series of rising diphthongs. Since there are no vowel sequences in the language which do not involve high vowels, it would suggest that these high glides are consonants rather than vowel sequences or diphthongs. We will see later in Section 2.4.3 that there are rising diphthongs occuring in the language. Their behavior is quite different from what we see in these examples. Therefore, we will conclude that they are consonants.

Logically it is, of course, possible to regard these palatalized and labialized contoids as single phonemes or as sequences of two phonemes. Let us examine the evidence.

	C+y	Gloss	C+w	Gloss
(44)	bʸɛ́l	millet	bʷɔ̰lɔ̰	corn cob
(45)	cʸɑ̰ŋ	days	cʷɑ̰k	type of fish
(46)	dʸɛ̀l	goat	dʷɔ̋r	Kudu, antelope
(47)	ɖʸɑŋ	cow	ɖʷɔ̰t	to rise
(48)	gʸɛ̰k	Nile Lechwe	gʷɔk	work
(49)	jʸɑ́k	2nd milking	jʷɔk	sickness
(50)	kʸɛ̰ɲ	horse	kʷéy	grandfather
(51)	lʸɛ̰c	elephant	lʷák	barn
(52)	àmyʸɛ̰l	stubborn	mʷɔl	morning
(53)	_____		ònʷà:ŋɔ̀	black ants
(54)	ɲʸa:yɔ	fish trapped by flooding	ɲʷɛlɔ	earthworm
(55)	ŋʸɛl	to trundle	ŋʷéc	Nile Monitor
(56)	pʸɛ̰w	heart	pʷɔ̰:ɖɔ̰	field
(57)	óřʸál	mongoose	_____	
(58)	ótʸɛ̰m	dragonfly	ótʷɛl	type of fish
(59)	ʈʸɛw	also	ʈʷɔ̰l	snake
(60)	_____		yʷɔ̰t	flying termites

There are a few 'missing' items which should be accounted for. In (53) we see that there is no 'n'+'y'. It seems to have merged with the [ɲ] and is no longer in the system. There is no occasion in the data base when [ɲy] or [ɲw] occurs. This may be because

the initial [n̰] is rather rare. There is no reason to assume that they could not occur, and their absence is most likely the result of insufficient data. The only other sequences which may not occur are /řw/, /wy/, /yy/ and /ww/.

In order to determine how to analyze these palatalized and labialized contoids, we must consider several points. First, there is virtually no co-occurrence restriction on the consonants. Secondly, there are no unambiguous sequences of consonants. In all consonant clusters in stem-initial position the second element can *only* be one of the high glides. Now let us consider its occurrence with the stem vowel.

	Cy + V	Gloss	Cw + V	Gloss
(61)			ácwīk	hip joint
(62)	byɛ́l	millet	gwɛ́m	cheating
(63)	cyá̰:dɔ̰	likeness	cwà:gɔ̀	support
(64)			cwɔ̰́:gɔ̰	pretense
(65)			cwɔ̀r	blind person
(66)			obwṵɲɔ̰	foreigner

The data (61-66) show that the only vowel sequences in the language involve high vowels. There are no unambiguous sequences of two vowels or three vowels. Both front and back vowels may occur with [y,w].

To summarize, there are no unambiguous sequences of vowels or consonants. There seems to be no obvious 'front' or 'back' restriction on co-occurrence of vowels with /y/ even though there is a limited distribution. There is virtually no co-occurrence restriction on consonant + semivowel.

While the analysis of the facts is not completely clear-cut, it seems more economical from a phonological point of view to consider the consonant + semivowel as representing a sequence of consonants rather than as representing a distinct series of phonemes.

It is also important to note that this 'sequence' of consonant + glide only occurs initially in the root. We will see throughout the thesis that the root is an extremely important part of Shilluk words, and that recognizing the root is vital throughout the phonology.

Two sequences cannot occur with the onset of a Shilluk root; namely, *[rw], *[wy]. Further, the [y] glide cannot be followed by [i] or [ḭ].

The basic phoneme chart as it now stands is as follows:

(67)

p	ṭ	t	c	k
pʰ	ṭʰ	tʰ	cʰ	kʰ
b	ḍ	d	j	g
m	n̰	n	ɲ	ŋ
m̰	n̰̰	n̰	ɲ̰	ŋ̰
w		l	y	
w̰		l̰	y̰	
		řř		

2.1.2 Remaining Phonetic Contoids

The phones still unaccounted for are the fortis contoids, the trilled vibrant and the aspirated plosives. We shall deal with these in two sections. First I will deal with Fortis Contoids, and secondly the Plosives.

2.1.2.1 Fortis Contoids

In the transcription, the fortis marking is indicated by (ˌ) under the symbol. When these fortis consonants are said in slow, deliberate speech, they are, in fact, geminate or lengthened consonants. One Shilluk described the effect similar to having a bit of glue on his tongue that held it to the roof of his mouth. In slow speech, these sound much like geminate consonants in Arabic. However, once produced at normal speed, the difference is certainly not one of length. Below are examples showing slow speech and normal speed.

	Slow Speech	Regular Speed	Gloss
(68)	θal:a[5]	θaḷa	'to cook'
(69)	cíŋ:é	cíŋ̣é	'his hands'

Thus, we could say that the fortis consonants have two phonetic productions, one for slow, deliberate speech, e.g. [m:], and one for normal or rapid speech, e.g. [m̩]. We might write the rule for this in the following way:

(70) Phonetic Realization Rules

phonologically long sonorants are realized as: →
[m̩,n̩,ɲ̩,ɲ̩,ŋ̩,l̩,r̩,w̩,y̩]/ rapid speech
and as [m:,n̪:,n:,ɲ:,ŋ:,l:,r̪:,w:,y:]/ deliberate speech

Geminates may only be heard intervocalically. At the end of the words there are no geminate sonorants or nasals.

2.1.2.2 Plosives

The only set of contoids left to consider are the plosives. We would expect that all plosives could be geminated. So, what is the phonetic realization of gemination in this case?

If we look at the root-final consonant of a plural word, we will find either a fortis sonorant or an aspirated plosive. When said in deliberate speech, the aspirated plosive is manifestly a geminate or lengthened plosive. Thus, we may conclude that intervocalically, double plosives are durationally long in slow speech and aspirated in normal speech.[6]

(71) Plosive Realization Rules

phonologically long plosives are realized as: →
[p:,θ:[5],t:,c:,k:] / intervocalically deliberate speech
[pʰ,θʰ,tʰ,cʰ,kʰ] / intervocalically, normal speech

Since the [c] may also be produced as an affricate, [tʃ], it should be clarified that the lengthening is evidenced on the closure phase.

Usually in word-final position, plosives are voiceless. There is a regular rule of word-final devoicing such that all plosives become voiceless word-finally. The realization rule can be stated as follows.

(72) Single Plosive Realization Rule

phonologically voiced plosives are realized as:
[p,θ,t,c,k] / word-finally
and [b,ɗ,d,ɟ,g] / elsewhere

phonologically voiceless
plosives are realized as: [p,θ,t,c,k]

It has been decided that the palatalized and labialized consonants are sequences of phones, and so do not need to be included in our chart.

2.1.2.3 Summary with respect to Consonants

At this point, all the 'phones' in the original Phonetic Chart have been accounted for. The resulting list of Shilluk consonants are shown here. Shilluk has five phonetically relevant points of articulation: bilabial, dental, alveolar, palatal and velar. There are oral (voiced and voiceless) and nasal plosives and a set of non-nasal sonorants.

Plosives	Oral	Voiceless	p	θ	t	c	k
		Voiced	b	ɗ	d	ɟ	g
	Nasal		m	ɱ	n	ɲ	ŋ
Non-nasal Sonorants			(w)		l	y	(w)
					r		

Before going any further, let us examine the vocoids.

2.1.3 Vocoids

There are ten vowels in the Shilluk vowel system. They may be divided into two sets according to the feature of Expanded Pharynx [± Ex].

The term Advanced Tongue Root [ATR] has been employed in some languages to describe this phenomenon. However, the term Expanded Pharynx (Lindau, 1979) seems to be more accurate for Shilluk. The [+ Ex] vowels are distinguished acoustically or impressionistically by a muffled or 'breathy' quality while the [− Ex] vowels have been described as 'brassy' (Jacobson, 1980). Most of the front vowels are phonetically similar in vowel height. The back vowels differ somewhat.

[− Ex]		[+ Ex]	
i	o	i̤	ṳ
ɛ	ɔ	ɛ̤	ɔ̤
a		ə̤	

For the sake of convenience, the "breathy" vowels, which are actually [+ Expanded Pharynx], [+ Ex], vowels will be underscored. [ɛ] and [ɛ̲] will be written as /e/ and /e̲/. The [ɔ̲] fits into the system as the [+ Ex] counterpart of [ɔ], and so will be written as /ɔ̲/. For the purposes of this thesis, the [+ Ex] value will be indicated by an underscore on all vowels except [u], and the vowel symbols will be [i,e,a,ɔ,o,u]. Below is a chart using the symbols as they will appear in this thesis.

[− Ex]			[+ Ex]	
i		o	i̲	u
e		ɔ	e̲	ɔ̲
	a			a̲

In addition, each of these ten vowels may be lengthened. We have seen that each one contrasts in identical or near identical environments from examples (34) - (43). Thus, we may set up a phonemic chart of vowel phonemes.

(73) Vowel Phonemes

	Front				Back			
	Unrounded				Unrounded		Rounded	
High	i	i:	i̲	i̲:			o o: u u:	
Low	e	e:	e̲	e̲:	a	a: a̲ a̲:	ɔ	ɔ: ɔ̲ ɔ̲:

We may account for the remaining phones by the following rules.

(74) Vowel Phonemes

/e:/ → [æ:]
/a̲/ → [ə̲]
/ɔ̲/ → [o̲]
/u/ → [ʊ̲] / ____ Nasal Consonant

Having decided on the phonemes of Shilluk, there are still some unanswered questions. Taxonomic Phonemics asks 'What?', not 'Why?' In order to capture the generalizations in Shilluk, we will turn to Generative Phonology. We begin by establishing the Distinctive Features of Shilluk.

2.2 Classificatory Features

In this section, I will be discussing the Distinctive Features needed for Shilluk consonants. To begin, I have shown a matrix with the features listed along with the '±' values. After the matrix, the justification for each of the features is given. Finally, the minimal feature matrix is given along with the relevant rules.

	Voc	Voi	Son	Nas	CCl	Occ	Vib	Rd	Lab	Api	Cor	Hi
p	−	−	−	−	+	+	−	−	+	−	−	−
b	−	+	−	−	+	+	−	−	+	−	−	−
θ	−	−	−	−	+	+	−	−	−	+	+	−
ɗ	−	+	−	−	+	+	−	−	−	+	+	−
t	−	−	−	−	+	+	−	−	−	−	+	−
d	−	+	−	−	+	+	−	−	−	−	+	−
c	−	−	−	−	+	+	−	−	−	−	+	+
j	−	+	−	−	+	+	−	−	−	−	+	+
k	−	−	−	−	+	+	−	−	−	−	−	+
g	−	+	−	−	+	+	−	−	−	−	−	+
m	−	+	+	+	+	+	−	−	+	−	−	−
ɱ	−	+	+	+	+	+	−	−	−	+	+	−
n	−	+	+	+	+	+	−	−	−	−	+	−
ɲ	−	+	+	+	+	+	−	−	−	−	+	+
ŋ	−	+	+	+	+	+	−	−	−	−	−	+
w	+	+	+	−	−	−	−	+	+	−	−	+
y	+	+	+	−	−	−	−	−	−	−	+	+
l	−	+	+	−	+	−	−	−	−	−	+	−
r	−	+	+	−	+	−	+	−	−	−	+	−

Chart 3: Distinctive Feature Matrix for Consonants

The features have been used because of the morphological processes involved. Sommerstein (1977:97) has said that "The criterion of morphophonemic relevance is ... of more value in confirming the systematic status of a feature than in disconfirming it ".

The first feature listed in the matrix is [Voc] or vocalic. If the analysis were a linear one, the feature [Consonantal] would need to be included. However, within the non-linear framework, the syllable structure will define the consonants and vowels. When a [w] or [y] occurs, the [+Voc] feature will be sufficient identification, and the syllable structure will define it as a consonant. The feature [Voc] will be retained in order to discuss the glides which occur in stem onsets.

The feature [Voice], [Voi], is needed to distinguish the voiced and voiceless plosives. The Sonorant [Son] feature will separate plosives in Shilluk from all the other phonemes. There is good evidence that plosives in the language behave in a very different way from other consonants. It is necessary to distinguish Nasal [Nas] as a separate class within the [Son] class because there is an interesting interaction between [Nas] and non-nasal stops which needs to be captured.

There is strong morphophonemic evidence that we need the features Central Closure [CCl] and Occlusive [Occ]. [CCl] is defined by Sommerstein as a complete closure involving the center of the oral tract. By contrast, [Occ] blocks the flow of air in the mouth. Thus, the feature [Occ] provides a useful category for discussing the alternation between plosives and nasals seen in Section 5.3, examples (96 - 107). The [Occ] feature will exclude the [l,r] which do not participate in the process.

There is another alternation between /l,r/ and /d/ discussed in Section 3.2.2.2. Without the feature [CCl] there would be no natural class defined for this morphological

interaction. The /l/ and /r/ must be distinguished from each other. Therefore, we need the category Vibrant, [Vib].

/w/ and /y/ are distinguished by the features [Lab] (for /w/) and [Cor] (for /y/). The feature [Rd] is not necessary for the consonants. However, it is used in the Vowel Feature Matrix. In order for /w/ and /u/ to have the same feature specification, the feature [Rd] has been included in the Consonant Feature Matrix.

Now we come to the point of articulation features. The categories Labial [Lab], Apical [Api], Coronal [Cor], and High [Hi] have been set up. The feature Anterior has not been used since there are no processes which necessarily link [Lab] with [Api] and/or [Cor]. There is a phonotactic constraint that affects all [+Cor, +Occ] segments; namely, one that concerns the feature [±Api]. The tip of the tongue is decidedly the important factor separating the Dental and Alveolar [+Occ] segments. For these reasons, [Cor] seems to be a more relevant category than [Anterior]. The combination of [Cor] and [Hi] will distinguish the Palatals. The velars will be [−Cor] and [+Hi].

The features specified for vowels ideally should be the same as for consonants and vice versa according to the Feature Minimalization Principle (Archangeli, 1984:50). According to this principle, it is most desirable to include the minimal number of features necessary to make differences between the phonemes of the language.

The features used for the vowel system are [Hi], Low [Lo] and [Rd]. [Hi] is used with the consonants. However, there are no [Lo] consonants in Shilluk, but the use of [Lo] seems unavoidable in the vowels. Round is not necessary for the consonants, but it is being used redundantly because it is needed for the vowels. [Back] could have been chosen for the vowels, but this feature would have been less relevant to the consonants. Thus, the /u/ and /i/ will have the same specifications as the /w/ and /y/; namely, [+Hi, +Rd] and [+Hi, −Rd] respectively. [Ex] will distinguish the two sets of vowels. It is not shown in the matrix since all vowels may be either [±Ex]. The assignment of the [Ex] feature is made in the Lexicon. Let us now consider the feature matrix for vowels.

	Hi	Lo	Rd
i	+	−	−
e	−	−	−
a	−	+	−
ɔ	−	−	+
o	+	−	+

Chart 4: Distinctive Feature Matrix for Vowels

2.3 Redundancy Rules

Much of the information contained in such a fully specifed matrix is often nondistinctive or redundant. It is desirable to select the most fundamental differences between the representations for the underlying representation. The redundancies can then be supplied by redundancy rules which are in part universal. The universal rules are 'cost free' since they do not need to be 'learned.'

The theory of Underspecification developed by Archangeli (1984) argues for including only the bare minimum of information. A fuller account of Underspecification Theory is found in Section 1.2.2.3. The features to be specified are given in the

Distinctive Feature Matrix. The unspecified features are filled in by either a Complement Rule or a Default Rule.

One of the advantages of Underspecification Theory is the way in which it explains the asymmetric behavior of certain consonants or vowels. For example, an epenthetic vowel is considered to be the maximally underspecified vowel. At the end of the derivation, it receives its specification and appears by default on all empty syllable heads. We will find this concept helpful as we look at Shilluk. First, though, let us examine an underspecified matrix for Shilluk consonants.

	Voc	Voi	Son	Nas	CCl	Occ	Vib	Rd	Lab	Api	Cor	Hi
p						+			+			
b		+				+			+			
θ						+				+		
ɗ		+				+					+	
t						+					+	−
d		+				+					+	−
c						+					+	
j		+				+					+	
k						+						
g		+				+						
m				+					+			
ɳ				+						+		
n				+							+	−
ɲ				+							+	
ŋ				+								
w	+								+			
y	+										+	
l			+		+						+	
r							+					

Chart 5: Matrix of Underspecified Features for Shilluk

The minimally specified consonant in Shilluk is /k/. My justification for this analysis is based on the observation that the /k/ often does not appear on the surface when it is expected to be there. For example, in the phrase arum ki + (Verb), the production in normal speech is [arumi_____] 'someone finished ____ing.'

In another common phrase [ɗɔ cɔl:ɔ] 'Shilluk language' the literal meaning is 'mouth of the Shilluk'. Since the word for 'mouth' is [ɗɔk], it suggests that underlyingly [ɗɔ cɔl:ɔ] is /ɗɔk cɔl:ɔ/. A similar elision happens with the word for 'door' or 'mouth of the house' where /ɗɔk ɔt/ surfaces as [ɗɔ ɔt]. When asked to produce the phrases mentioned in a word for word fashion, the /k/ reappears. There seems to be no objection to writing the /k/ even though it is not normally pronounced. People seem to acknowledge its 'underlying presence'.

Given the assumption that /k/ is the underspecified consonant, we have the following redundancy rules for Shilluk. The Complement Rules (CR) and Default Rules (DR) are labelled.

[ ] →	[−Vib]		CR	[ ] →[−Nas]			CR
[ ] →	[−Hi]/	[+$\overline{\text{Vib}}$]	DR	[ ] →[+Son]/	[+$\overline{\text{Nas}}$]		DR
[ ] →	[−Occ]/	[+$\overline{\text{Vib}}$]	DR	[ ] →[−Son]			CR
[ ] →	[+CCl]/	[+$\overline{\text{Vib}}$]	DR	[ ] →[+Voi]/	[+$\overline{\text{Son}}$]		DR
[ ] →	[+Son]/	[+$\overline{\text{Vib}}$]	DR	[ ] →[−Occ]			CR
[ ] →	[+Cor]/	[+$\overline{\text{Vib}}$]	DR	[ ] →[+Occ]/	[+$\overline{\text{Nas}}$]		DR
[ ] →	[−Voc]		CR	[ ] →[+CCl]/	[+$\overline{\text{Occ}}$]		DR
[ ] →	[−CCl]/	[+$\overline{\text{Voc}}$]	DR	[ ] →[−Hi]/	$\begin{bmatrix}+\overline{\text{Son}}\\+\text{CCl}\\-\text{Nas}\end{bmatrix}$		DR
[ ] →	[+Son]/	[+$\overline{\text{Voc}}$]	DR				
[ ] →	[−Occ]/	[+$\overline{\text{Voc}}$]	DR	[ ] →[−Voi]			CR
[ ] →	[−Lab]		CR				
[ ] →	[+Rd]/	$\begin{bmatrix}+\overline{\text{Voc}}\\+\text{Lab}\end{bmatrix}$	DR	[ ] →[−Rd]			CR
				[ ] →[−Cor]			CR
[ ] →	[−Hi]/	$\begin{bmatrix}-\overline{\text{Voc}}\\+\text{Lab}\end{bmatrix}$	DR	[ ] →[+Hi]			CR
[ ] →	[−Api]		CR				
[ ] →	[−Hi]/	[+$\overline{\text{Api}}$]	DR				
[ ] →	[+Cor]/	[+$\overline{\text{Api}}$]	DR				

The Underspecified Matrix for the vowels is much simpler. The maximally underspecified vowel is /i/. There are two main reasons for proposing this analysis. First, /i/ tends to be the least stable vowel. In the mono-syllabification process that seems to be at work in the language, the /i/ is the vowel most easily 'lost'. The Plural I Incorporation process, which is described in detail in Chapter Four, involves moving an -i plural suffix into the root of the word. However, the -i never surfaces as [i] after this process. The syllable structure of the word changes, thus giving evidence of its presence, but it takes on the features of the root vowel. As a maximally underspecified vowel, it can be seen as having no features of its own. Therefore, it is reasonable to assume that it would simply 'acquire' features by assimilating the features of the vowel with which it shares a syllable head.

The second reason for positing /i/ as the maximally underspecified vowel is its epenthetic behavior. While epenthesis is not a regular process of the language, in rapid speech, an /i/ is often inserted to separate consonants. When the same sequence is repeated in slow speech, the /i/ is no longer present, but a slight pause will separate the consonants.

Another point that should be made is that the same CR is needed for both the /k/ and the /i/; namely, [ ] → [+Hi]. This CR is independently motivated for both segments.

Finally, the articulatory setting for Shilluk provides one further argument in favor of Non-Specified Status for the /i/. The Shilluk's often remove their lower incisors at puberty. As a result of this physical alteration, the tongue tip shifts forward thus placing the body of the tongue in a more palatal position. This articulatory setting seems to parallel the [+Hi] feature for both the Non-Specified Segment for the vowel and the minimally specified segment for the consonant.

The Underspecified Feature Matrix for Shilluk vowels is given below. Again, the [Ex] feature is not included in the Matrix since it is Lexically assigned and may apply equally to all vowels.

	Hi	Lo	Rd
i			
e	−		−
a		+	
ɔ	−		+
o			+

Chart 6: Matrix for Underspecified Shilluk Vowels

The Redundancy Rules for vowels are:

[ ] →	[−Lo]	___	CR
[ ] →	[−Hi]/	[+$\overline{\text{Lo}}$]	DR
[ ] →	[−Rd]		CR
[ ] →	[+Hi]		CR

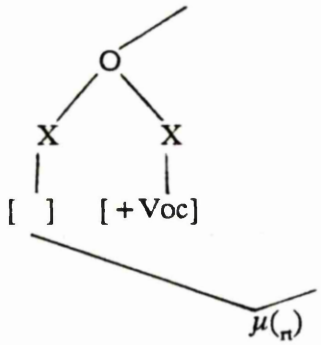
2.4 Non-linear Analysis

The problem with a segmental analysis is that the phonological representation has been oversimplified (van der Hulst and Smith, 1982:3). A non-linear analysis allows us the freedom to develop these representations to a greater extent. The end result provides more explanatory power as we capture the generalizations that would otherwise be missed.

The constraints for the onset of the root can now be stated in non-linear terms. We begin with the Initial Consonant Sequence which allows for glides to follow consonants at the beginning of a root morpheme.

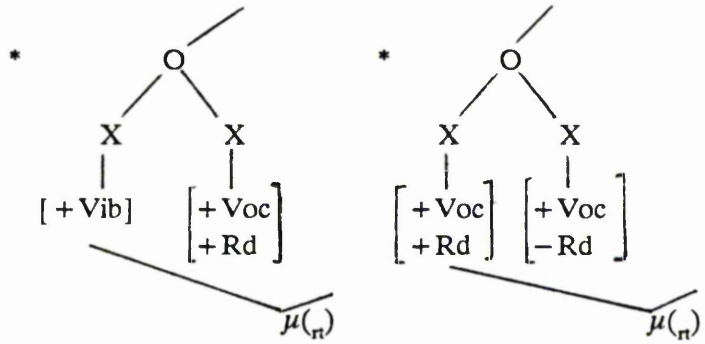
(For the reader's convenience, an alphabetized listing of abbreviations, example number and name of rule or constraint discussed within each chapter is shown at the end of that chapter.)

(78) Initial Consonant Sequence (ICS)



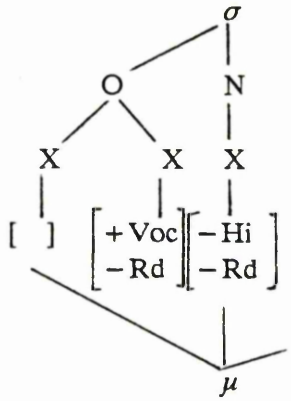
Two constraints are placed on the initial root sequences.

(79) Initial Consonant Sequence Constraint (ICSC)



These two constraints disallow the sequences *[rw] and *[wy]. There is a further constraint with regard to the glide and the following vowel. This constraint is shown in (80).

(80) Glide and Vowel Constraint (GVC)



In this constraint (80), the [y] glide may only be followed by a vowel which is [−Hi, −Rd].

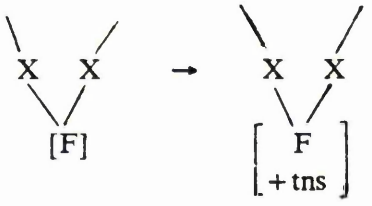
One new feature will be introduced. The feature in question is [tense]. It is important to point out here that this feature does not belong in the Classificatory Matrix. This particular feature is relevant only at the Post-lexical level. According to the principle of structure preservation, new phonemes are not allowed to appear at the Lexical level. However, post-lexically, new 'phonetic' sounds are permitted. Since this feature cannot be generally applied throughout the phonology as can the other features, we recognize that it is a late-comer which can come into operation only at either the Post-lexical or Phonetic levels.

2.4.1 Geminates

We begin our analysis by looking at gemination of consonants. Particularly, we want to investigate the factors that relate to the fortis realization of geminate consonants.

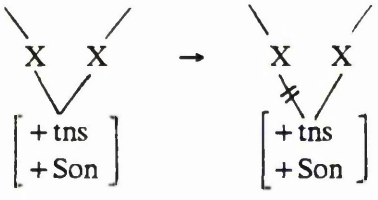
Hock (1986) states that in the cases of Hindi and W. Germanic, geminate consonants are more 'fortis' than single segments. We need to account for the relationship between a geminate consonant and the feature [tense]. First, we have a Tensing Rule which introduces the feature [+tns] with geminate consonants.

(81) Tensing Rule (TR)



This rule will apply to *any* geminate consonants. It will completely account for the Vibrants too, so long as we understand that the [r] is [+tns] while the [ɾ] is [−tns]. However, to deal with the other sonorants and nasals, we will need a further rule which accounts for the phonetic shortening of these [+tns] consonants. Consider the Phonetic Shortening Rule below.

(82) Phonetic Shortening Rule (PSR)



The Tensing Rule is intrinsically ordered before the Shortening Rule in a feeding relationship. Sonorants (including Nasals) which are [+tns] are shortened in normal speech. They maintain their [+tns] feature which is realized by a fortis production. Let us look at some sample derivations using these rules.

	cin̪n̪e cin̪e	
(83)	/cin̪n̪+e/ 'his hands'	/adeřře/ 'his donkeys'
TR	cin̪n̪e	adeřře
PSR	cin̪e	———
SF	[cin̪e]	[adeře]

Gemination is not uncommon in Nilotic languages. Recent studies have shown that gemination appears in Anywak (Reh, personal communication), Alur (Kutsch Lojenga, personal communication), Lotuho (Coates, 1985), and Mabaan (Walker, personal communication). There is also further evidence from plosives in Dinka that would indicate the presence of underlying geminates (Duerkson, personal communication.)

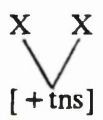
These 'geminates' are not usually characterized by increased duration. Consonants are described in Lotuho as being 'strong' or 'weak', but certainly *not* long or short.[7] (Hollman, personal communication and Coates, 1985). In Alur, the 'geminate' plosives are realized as voiceless aspirated consonants with no special feature of increased length. Thus, we are not suggesting something 'new', but simply proposing an analysis that has not been previously mooted for in Shilluk.

Shilluk has long vowels. As such, length is distinctive within the vowel system. It is not implausible, then, that this feature of length would also be evident in the consonant system.

While geminate consonants have a unique phonetic realization in Shilluk, it is not being suggested at this point, that this realization is relevant to the Classificatory Matrix. In fact, the contrast is a structural one in which a set of features is assigned to either one or two X slots.

It is still possible to hear both fortis consonants and lengthened consonants from the same speaker in the same words — spoken at different rates. In years to come, it is possible that that distinction may be lost at which point, the fortis productions may become part of the phonological system. For the present, however, we are still able to see the relationship between the segmental feature [tns] and the multi-tiered representation of gemination.

(84)



This association of [tns] and gemination is somewhat parallel to the case of differential vowel length before voiced and voiceless stops in English. The plosive voicing is what is 'thought' to be the distinguishing feature. However, the real 'clue' lies in the vowel length.

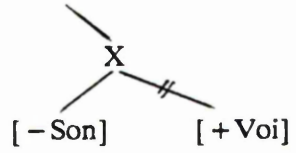
'rope'	'robe'
[o]	[o:]

With Shilluk, the feature of [tns] may become distinctive in the future, but for now it is only needed in a Phonetic Feature Matrix.

2.4.2 Plosives

We turn our attention now to the Plosives. First, there is a post-lexical rule which devoices all plosives syllable-finally. In actual fact, this process can be described at a syllable level in that plosives in coda position are devoiced.

(85) Syllable-Final Devoicing (SFD)



There are plosives which are voiceless underlyingly. Those plosives would surface as voiceless even in syllable onset position. Underlyingly voiced plosives would surface as voiced in syllable onset position. Below are examples of the voiceless plosives.

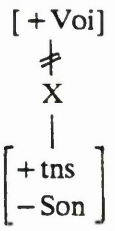
	Word	Gloss
(86)	búkɔ̰	Khartoum
(87)	ànwàtɔ̀	white worm

An example of the SFD rule is shown here.

(88) /leb/ → lep → [lep] 'tongue'
SFD SF

Hock (1986) also says that the fortis characteristic is responsible for devoicing such that [+ tns] tends to imply [− Voice]. This tendency is certainly evident in Shilluk plosives. We see in the following rule for Shilluk that [− Son, + tns] consonants are associated with [− Voice].

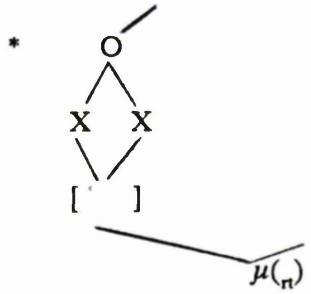
(89) Tense-Voicing Rule (TVR)



This rule says that if a [− Son] consonant is also associated with the feature [+ tns], then if it is also associated with [+ Voi], the voicing is delinked. The result of this delinking is a voiceless plosive. For ease of notation, the rule is stated with a single rather than a double X.

In order to prevent geminate consonants from occurring in the root-initial position, one further Initial Consonant Sequence Constraint needs to be formulated.

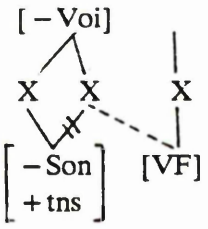
(90) Initial Geminate Consonant Sequence Constraint (IGCSC)



Geminate consonants cannot occur in the Onset position within a root morpheme.

Not only are intervocalic plosives voiceless, they are also aspirated. Presumably this Intervocalic Aspiration Rule applies after the Tensing Rule in (89). The aspiration can be looked upon as a delinking of the [−Son] feature. The [−Voi] is retained while the vowel features spread to the left from the nucleus creating the aspiration. The rule is given below.

(91) Intervocalic Aspiration Rule (IAR)



Now we will show how these rules work together to derive the surface plosive consonants.

(92)	/dadd + e/ 'its hooves'	(93)	/daadd/ 'hooves'
TR	daṭṭe		daaṭṭ
CSP	———		daaṭ (see 4.15)
IAR	dat^{h}e		———
SF	[dat^{h}e]		[da:t]

(94)	/dud/ 'loin cloth'	/dud + e/ 'his loin cloth'
SFD	dut	———
SF	[dut]	[dude]

In summary, then, all geminate consonants undergo the Tensing Rule (81). The [+Son] geminates also undergo the Phonetic Shortening Rule (82). The result is a short, fortis consonant.

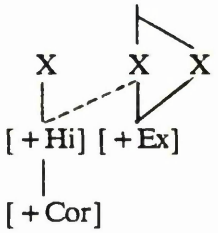
The Plosives, [−Son], on the other hand, undergo the Tense-Voicing Rule (89) after the Tensing Rule (81). The devoiced plosive is then aspirated intervocalically by the Intervocalic Aspiration Rule (91). For syllable-final geminate plosives, it is unclear at

this time whether the TVR applies before or after the syllabification principle found in Chapter Four (CSP, 4.15). There is some evidence to suggest that degeminated final plosives are unreleased while single plosives have a light release. If the CSP applies first, before the Tensing Rule, then the release should be the same for single and geminate root-final plosives. However, if there is a released/unreleased contrast, it would mean that the Tensing Rule applies before the CSP which delinks one of the timing slots for the geminate consonants in a coda slot of the syllable. Further investigation into this area is needed.

2.4.3 Phonetic Rules for Vowels

Two Phonetic rules need to be stated for Shilluk vowels. The first of these is an On-glide Insertion Rule.

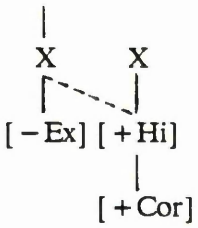
(95) Diphthong High Spreading Rule (DHSR)



In this rule, the [Hi] feature spreads from the root-initial palatal consonant onto the nucleus which has the feature [+Ex]. It is also a requirement that the Nucleus be realized as a long vowel. This inserted glide is a phonetic transition from the palatal consonant into the vowel, i.e., a rising diphthong. This diphthong should not be confused with the semi-vowel in the complex onset. At the phonetic level, the difference is neutralized. However, in environments where the vowel shortens, the underlying difference is apparent. The [y] will remain with a shortened [+Ex] vowel whereas the [i] on-glide, or rising diphthong, will disappear, since the conditions for its appearance are no longer present.

The second rule refers to the Off-glide High Spreading Rule. Its conditions are almost the reverse of the ones for the On-glide.

(96) Off-glide High Spreading Rule (OHSR)



The Off-glide High Spreading Rule allows for [Hi] spreading from the palatal consonant to the [−Ex] vowel to its left. The Nucleus must be realized as a short vowel for this rule to apply. Again, the transient nature of this rule is seen when the vowel is

lengthened. The off-glide is no longer present when the [−Ex] vowel is long. Below are examples of both the rising diphthong and the off-glide.

	UF	Rule	SF	Gloss
(97a)	/yɛ̱ɛ̱jɔ̱/	DHSR	[yⁱɛ̱:jɔ̱]	rat
(97b)	/ɲa̱a̱lɔ̱/	DHSR	[ɲⁱa̱:lɔ̱]	reticulate python
(98a)	/mac/	OHSR	[maⁱc]	fire
(98b)	/lɔɲ/	OHSR	[lɔⁱɲ]	small animal

2.4.4 Vowel Length

Shilluk has four phonetic degrees of length. The [+Ex] vowels tend to be longer than the [−Ex] set. Phonemically, there are two degrees of vowel length.

	Word	Gloss
(99)	gól	household
(100)	gɔ́:l	Wild Dog
(101)	áŋūn	sickle
(102)	áŋū:ŋ	mucous

While phonemically there are only two degrees of length, the problem of vowel length is a bit more complicated. There are underlying short vowels and long vowels. There is a third set which is underlyingly long, but which is sensitive to a shortening rule within closed syllables. This phenomenon is dealt with in Chapter Four. Length is not considered to be a Distinctive Feature in Shilluk. Instead, length differences are handled by means of a structural distinction using X slots. It is mentioned here to make the point that there is no phonetic difference in the length of vowels that shorten in closed syllables and those that do not shorten.

Our final vowel chart is as follows:

	Front		Back			
	Unrounded		Unrounded		Rounded	
High	i	i̱			o	u
	e	ɛ̱			ɔ	ɔ̱
Low			a	a̱		

The underscored vowels and /u/ are [+Ex] while the /i,e,a,ɔ,o/ are [−Ex]. All vowels may be long or short.

2.5 Phonetic Tone

On the surface, Shilluk has three distinctive pitch levels. These three may be termed High, Mid and Low (H,M,L). The interval between H and M seems to be approximately equal to the interval between M and L. Thus, between H and L, we find two intervals. These relative intervals may be shown in a diagrammatic pitch notation as shown below.

(103) HM [¯ –] ML [– _] HL [¯ _]

MH [– ¯] LM [_ –] LH [_ ¯]

For a given speaker, the absolute level of each distinctive pitch is maintained fairly consistently throughout an utterance as shown below.

(104) [– ¯ _ ¯¯ – – ¯]
ka tyeŋ pa-ani pyɛ̱c yi̱ wɔn.
And the people of this village were asked by us.

(105) [– _ _ _ _ _ ¯]
ge yɔ̱:ti be cayi wɔn.
They began to blame us.

All of the H's in example (104) are realized on much the same pitch, as are all the M's. In example (105), the L's are all on the same pitch as well, with the H at the end realized as higher than the initial M. It is concluded, therefore, that there is no downdrift nor any automatic downstep.

An attempt will be made to account for the three pitches in terms of two underlying tones. However, we will see in the end that the three pitch levels in Shilluk correspond underlyingly to three level tones. Let us begin our discussion by an examination of the data.

We turn first to one-syllable words. In the examples below, there are contrasts among all three pitch levels, H,M,L. The first set (106 - 108) of three words has [−Ex] vowels. The second set has the C+semivowel onset (109 - 111). The third set (112 - 114) has an [+Ex] vowel.

	Tone	Word	Gloss
(106)	H	bák	garden
(107)	M	bāŋ	cow with drooping horns
(108)	L	bàk	guess!
(109)	H	byél	millet (pl)
(110)	M	byĕr	roots
(111)	L	byèl	carry!
(112)	H	kɛ̱́r	wealthy
(113)	M	kɛ̱̄c	hunger
(114)	L	kɛ̱̀p	raid

As we have seen, there are also two types of two-syllable words in Shilluk. We will begin with the Prefix + Root and then move on to words with the pattern of Root + Suffix. We will note the differences between them. (The term 'Root' in this thesis has a specialized meaning which is discussed in Section 5.1.2.)

In the examples below, we find the following sequences of tones H-H, H-M, H-L, M-L, L-H, L-M, L-L. Consider these words.

	Tone	Word	Gloss
(115)	HH	álám	dragnet
(116)	HM	átwēl	stem of plant
(117)	HL	ágàk	raven
(118)	ML	ādwɔ̀k	gum trees
(119)	LH	àdúθ	stinger of bee
(120)	LM	àbɔ̄y	rotten fish
(121)	LL	àdwɔ̀l	grain

The a- prefix may be H,M or L. The root may also be H,M,L so long as the prefix is H or L. If the prefix is M, then the only possible root tone is L. This is an interesting restriction which we shall need to keep in mind in the following discussion of M tone.

In order to see the patterns more clearly, a matrix is presented below. The tones indicated on the left are Prefix tones. Across the top are the root tones. An X in the box would mean that that particular combination of Prefix and Root tones is possible.

(122)

Root Tones

Prefix Tones	H	M	L
H	X	X	X
M			X
L	X	X	X

Before we continue discussing these patterns, we need to complete our survey of the facts. We move on to the Root + Suffix tone patterns.

	Tone	Word	Gloss
(123)	HH	dɔ́:rɔ́	axe
(124)	HM	gą́m:ī	midwives
(125)	HL	búdɔ̀	zucchini
(126)	MM	dɔ̄:dɔ̄	tumble bug
(127)	LL	dwà:lɔ̀	fat
(128)	LH	byè:lɔ́	stalk of millet

In these words, we see a rather more limited distribution. The root tone may be H,M,L. However, the co-occurence of suffix tones with these root tones seems rather restricted. The matrix below reveals what is missing.

(129)

Root Tone

	H	M	L
H	X		X
M	X	X	
L	X		X

Suffix Tone

We see that most of the restrictions involve the M tone. A M root tone cannot take a H or L suffix tone. Also, a L root tone cannot be followed by a M on the suffix.

Let us examine three-syllable words in the data below. The only level tones which occur are listed here.

	Tone	Word	Gloss
(130)	HLL	ácùŋ̀	black mound termite
(131)	LMH	àbā:rɔ́	fencing grass
(132)	LLL	àdùdɔ̀	large sieve

The distribution of tones is severely limited in these three-syllable words. Compound words are not within the scope of this thesis; so their tone patterns will not enter into this discussion.

It is interesting that the number of tone combinations decreases as the number of syllables increases. This is quite the opposite of what would be expected. With three tones on two-syllable words, we would expect nine possible tone combinations. With the same three tones on three-syllable words, there could be as many as 27 potential patterns. In Shilluk, we see only three patterns with level tones when words have three-syllables.

Perhaps the phenomenon can be explained by positing two tones in the underlying representation. If we can adequately account for surface [H,M,L] by this means, then it might explain the relatively few tone patterns in three-syllable words.

2.6 Interpretation of Tone

In the literature, it is pointed out that there are various ways to account for three surface pitch levels in terms of two tones. We will look at four of these; namely, assimilation, dissimilation, upstep, and downstep. Each of these approaches will be considered in turn.

2.6.1 Assimilation

In assimilation, Schuh (1978:230) says that tones "remain in their original segmental domain but become more like (perhaps identical to) neighboring tones". It would be possible, then to account for a M tone by assimilating L→M/__H or H→M/__L.

If that were the case, then there should be no distinction between L and M before H or between H and M before L. We see that is not the case from the following examples.

	Word	Word + ání	Gloss	Tone
(133)	dɔ́:rɔ́	dɔ́:rání	axe	[¯¯¯]
(134)	gɔ̄:lɔ̄	gɔ̄:lání	hook	[-¯¯]
(135)	lè:lɔ̀	lè:lání	stone	[_¯¯]

We see in these words that H,M and L all contrast in the environment of H. According to the principle of Assimilation, if /gɔɔlɔ/ were actually associated with a L tone, then it would be raised to a M because of the following H tone. However, we see in the word /leelɔ/ that it begins L and continues to be L even in the environment of a H. But let us look a bit further.

The possessive marker on a semantically singular noun consistently has a M tone. By

contrast, semantically plural nouns have a possessive marker with a H tone. As we have already seen that all three tones contrast with a H in examples (133 - 135) only data relating to the singulars followed by M tone will be given here.

	Word	Word + 3s Ps	Gloss	Tone
(136)	dɔ́:rɔ́	dɔ́:rɛ̄	axe	[¯ –]
(137)	gɔ̄:lɔ̄	gɔ̄:lɛ̄	hook	[– –]
(138)	lɛ̀:lɔ̀	lɛ̀:lɛ̄	stone	[_ –]

We see from these examples that H, M, and L tones all co-occur with the M suffix tone. As Assimilation is unable to account for the M tone, we reject any theory involving Assimilation and turn to Dissimilation and Polarization.

2.6.2 Dissimilation and Polarization

Schuh discusses the two processes of Dissimilation and Polarization. Dissimilation assumes there is an underlying tone which changes by a rule such as [+H] → [−H]/[+H]__. Polarization, on the other hand, applies to syllables with no underlying tone. A rule is posited to supply the unspecified tone such as Tone → [−*a*H]/[*a*H] __. Schuh states that in both cases, these rules are morphological and words must be marked if they are to undergo them. They do not apply as general phonological rules.

Given the frequency of M tone in Shilluk and the fact that any sequence of tones may occur, it would be highly uneconomical to have to specify every occurence of a rule application to account for it. It is unlikely that Dissimilation or Polarity could account for the third tone.

2.6.3 Upstep

Upstep is a rare phenomenon in the world's languages. Anderson (1978) cites two examples from the literature. An upstep language raises tones in a sequence of progressively higher tones. If we posit that a H tone would raise any subsequent tone, then we could say that a [HM] tone is /HL/ underlyingly. However, our argument would soon founder since, in Shilluk, [HM] contrasts with [HL].

Upstep should raise a following L, at least higher than a preceding L. However, we see in these examples that the L's are the same level.

	Tone	Word	Gloss
(139)	[_ _ ¯ _]	àbàθúrɔ̰̀	Nile Monitor Lizard
(140)	[¯ _ ¯ _]	áwɛ̰̀rtáwɛ̰̀:	day before yesterday

Thus, we cannot invoke upstep to account for the M tone.

2.6.4 Downstep

The literature is filled with accounts of languages with three or four pitches being analyzed as processes involving downstep (DS) (Anderson, 1978, Hyman, 1979 and 1985b, Goldsmith, 1976, Clements and Ford, 1981 — to mention only a few). There are so many possibilities that it is difficult to tell whether a language has three tones or DS — or even both in some cases (Hyman, 1986).

In an attempt to discriminate between a M tone and a Downstepped H (!H), Hyman (1986:128) has contrasted the characteristics of each one. No one characteristic should be taken as the deciding factor. However, taken together, we should be able to reach a concensus.

Hyman gives five characteristics. Only four will be discussed here since the last point — the frequency of a fourth tone — is irrelevant since Shilluk has only three pitch levels, not four.

2.6.4.1 After Pause

The first point Hyman makes is that a M tone is expected at the beginning of an utterance. A !H is not expected to contrast with H utterance-initial.

We turn to the data for Shilluk. H, M, and L tones contrast after pause (utterance-initial).

	Word	Gloss
(141)	ábámàc	type of bird
(142)	àcyén	curse
(143)	ādígáwɔ̀w	sunset
(144)	ādù:l	circular things
(145)	gɔ̄:lɔ̄	hook
(146)	wā:c	books
(147)	byēr	roots

We see from these examples that H,M and L tones contrast before pause. Further, we see that the M tone may be followed by a H,M, or L or may occur by itself as in (145) to (147). Thus, we have the answer to one question concerning interpreting the third tone as M rather than !H.

2.6.4.2 Ceiling

In Hyman's second point, a M tone should allow a higher pitch on a following H tone whereas a !H would lower the subsequent H to the same level. We know from previous examples (133) - (135) that H,M, and L may be followed by H across a morpheme boundary. Below we have further examples within single words.

	Word	Gloss	Tone
(148)	átu̍dǫ́	duck	[¯◝¯]
(149)	ókǫ̍t:ī	grainbins	[¯◝–]
(150)	ágą̍k:ì	ravens	[¯◝_]

Here we see that H,M, and L all contrast after HM. There is no ceiling set by the 'M' tone, and so we have one more 'point' in favor of M over !H.

2.6.4.3 Limitations

In his third criterion, Hyman indicates that a M tone is expected to be local, "affecting only a TBU or perhaps a single tonal autosegment". The !H is expected to be unbounded and can affect not only all the subsequent H's but any other tone as well. By

way of example, Hyman says the second L in the sequence L-H-!H-L is lower than the first L. However, if the sequence were L-H-M-L, the two L's would be the same.

Shilluk has very few four-syllable words, so we need to turn to phrases and sentences. As these rules are general phonological rules, any effects should be present over a longer string.

(151) [ˍ ˍ ˍ¯¯ ¯¯ ˍ ˍ ¯ ¯ ˍ ˍ◝]
ka jiy pa-ani rɪ̱:ŋa wɔk / / ki lwak ki jɔk mɔ gɪ̱:r.
And people of this village ran out from the barn with many men.

All L tones in this sentence are on much the same pitch. There is no sign of lowering even by means of downdrift.

We see, then, that the sequence L-H-M-L [ˍ¯ˍ ˍ] is what we get in Shilluk rather than L-H-!H-L [ˍ¯ˍ ˍ]. This fact adds a third point for interpreting our third pitch as a M tone.

2.6.4.4 Cumulative Effect

In Hyman's fourth (and our final) point, a M tone is not expected to be 'cumulative'. In principle, an indefinite series of !H's would be possible. However, lowering to a M followed by a second M would result in the two tones being at the same level. Several examples are given below showing various environments.

(152) [¯ ˍ ˍ ˍ¯ ˍ ˍ ˍ ˍ ¯]
kipaŋɔ arɔθ oθɔŋɔ ki yo:?
Why were the children attacked on the road?

(153) [ˍ ¯ ˍ ˍ ˍ◝]
ka omɪ̱a ɲel dwɔ̱ŋ
And my elder brother

(154) [ˍ ˍ ˍ¯¯ ¯¯ ˍ]
ka jiy pa-ani rɪ̱:ŋa wɔk.
And people of this village ran out.

In these three examples, we see that two to three 'M' tones may occur together and remain at the same level. Also, the 'M' tones may be preceded by either H or L. There is no compelling evidence to say that sequences of !H are present. Thus, we have the fourth point of four to adduce as evidence that our third pitch is, in fact, a M tone rather than !H.

2.6.5 Sequences

Now that we have decided that there are three level tones underlyingly in Shilluk, we may consider the rest of the facts about the tone. Not only are there three level tones, but nearly every possible sequence of tones is found on the root. Examples of level tones are repeated along with words having sequences of tones. A combination of tones marked with a ligature, such as H͡L, indicates a contour tone.

	Tone	Word	Gloss
(155)	H	bák	garden
(156)	M	bāŋ	cow with drooping horns
(157)	L	bàk	guess!
(158)	H͡L	bâŋ	servant
(159)	M͡L	bwə̂c	barren person
(160)	M͡H	bā́t	arm
(161)	L͡H	byə̌c	cow with horns straight out

The only sequence that is not found on the root (which is necessarily monosyllabic) is LM. The matrix below shows the tone patterns on roots. The H-H 'combination' simply means a level H. This is necessary in order to construct a complete matrix.

(162)

	H	M	L
H	X	X	X
M	X	X	X
L	X		X

Matrix of Root Tones

If we move on to the Prefix + Root words, we see that many of the tone sequences are possible.

	Tone	Word	Gloss
(163)	HH͡L	ábîp	measles
(164)	HL͡H	ámăl	camels (r) = 'rare'
(165)	LH͡L	àbôn	pastor
(166)	LL͡H	àyěk	sleeping cover

Once again, a matrix may help us to see the general patterns in the language.

(167)

Root Tones

Prefix Tones	H	M	L	HL	LH
H	X	X	X	X	X
M			X		
L	X	X	X	X	X

Prefix + Root Tone Matrix

At this point we are describing sequences of tones across a morpheme boundary; namely, the nominalizer prefix and the root. The new matrix is quite different from the first one (122).

There are a total of eleven tone patterns represented in the Prefix + Root words. We notice that there is a limited use of M tone on a prefix. There is also a noticeable absence of M tones within the contour tones on the root. There are no M͡H, H͡M or L͡M contours on the root even though M͡H and H͡M are present on monosyllabic roots.

We come, now, to an interesting situation. As we examine words which consist of Root + Suffix, we find that plurals seem to have a restricted distribution: HM, H͡LL, LL. These patterns are seen in the words below.

	Tone	Plural	Gloss
(168)	HM	gá̱m:ī	midwives
(169)	H͡LL	ɲwêl:ì	earthworms
(170)	LL	tùk:ì̱	rocks of mud

If we compare the tone patterns of singular words with the same Root + Suffix 'shape', we see quite a difference in the number of options.

	Tone	Sing.	Gloss
(171)	HH	dɔ́:rɔ́	axe
(172)	H͡MM	bá̱:ɲɔ̱	grasshopper
(173)	HL	búdɔ̀	zucchini
(174)	MM	dɔ̄:dɔ	tumble bug
(175)	M͡LL	bûgɔ̀	cow with dead calf
(176)	LL	dwà̱:lɔ̀	fat
(177)	LH	byɛ̀:lɔ́	stalk of millet

In Chapter Four, we discuss a process whereby plurals are derived. For the purpose of the present discussion, we will simply say that the plural suffix -i is moved into the root along with its tone. Technically, it then becomes a one-syllable word. However, if we include these derived plurals in our tone data for two-syllable words, we see that the tone patterns on plurals are not as restricted as was previously assumed. Consider the following.

	Tone	Plural	Gloss
(178)	H	kwé:r	small lizards (r)
(179a)	H͡M	bá̱:c	outer layers of plant
(179b)		gá̱m:ī	midwives
(180a)	H͡L	bâ̱:ɲ	grasshoppers
(180b)		ɲwêl:ì	earthworms
(181)	M	wā̱:c	books
(182)	M͡L	bā̱:t	arms
(183a)	L	dà:t	hooves
(183b)		tùk:ì̱	rocks of mud
(184)	L͡H	bwɔ̱̌:c	barren people

Before returning to our analysis, we will look at the three-syllable words. In our earlier version, we had only the level tones. We saw that there were very few tone possibilites of level tones on three-syllable words. In fact, there are quite a few more possibilities, but we must include tone sequences in order to see them. The same assumption is made here with regard to derived plurals, as was just discussed in the previous section.

	Tone	Word	Gloss
(185)	HH$\widehat{\text{L}}$LH	átûdo̱	duck
(186)	HH$\widehat{\text{L}}$LL	átê:gɔ̀	goat
(187)	HH$\widehat{\text{M}}$MM	álwe̋:dɔ̄	crab
(188)	HLL	ácùŋo̱	black mound termite
(189)	HH$\widehat{\text{M}}$ML	ágg̱a̱k:ì	ravens
(190)	ML	ādù:l	circular things
(191)	LMH	àbā:rɔ́	fencing grass
(192)	LH$\widehat{\text{L}}$LL	àbûro̱	reedbuck
(193)	LLL	àdùdo̱	large sieve
(194)	LH	ɲìbɔ́:w	white calves (r)
(195)	LL$\widehat{\text{H}}$	dìdŭ:k	dark grey bulls

It would seem that level tones are the exception rather than the rule on three-syllable words in Shilluk. If the hypothesis is true, that Western Nilotic languages are moving from multi-syllable words to mono-syllable words, then we can make some conjectures as to the tone. Goldsmith (1976) discusses the phenomenon of 'tone stability'. He argues that the tone melody is independently maintained even when the syllable structure of the word changes. The tone which is left without a Tone Bearing Unit (TBU), does not delete, but simply moves to the next available location.

Evidence from Shilluk would seem to confirm this principle of tone stability. As segments in Shilluk words were dropped, the tone shifted to the root. In three-syllable words, we see the resultant bunching of tones. However, as words got shorter still, it became necessary to utilize a M tone which is distinct, rather than the !H which it may have been. This would have been necessary in order to preserve the structure and semantic information. As words became even shorter, i.e., mono-syllables, all three level tones and most of the possible tone sequences had to be used in order to distinguish the segments from each other. Hence, there is a greater number of sequences allowed on monosyllabic roots than are allowed on two-syllable words. I posit these remarks only in a tentative way. Obviously, further research into the historical reconstruction would be needed to confirm such an hypothesis. However, such a study is not within the scope of this thesis. I will leave this idea for the present, and continue the analysis of tone in this chapter.

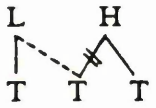
The remainder of our discussion of tone will focus on three areas. First, I will provide a further argument against spreading and tone assimilation based on the data just presented. Secondly, I will discuss the different tone patterns permitted between singular and plural nouns. Finally, the principles for relating the autosegmental tier with the timing tier will be discussed.

2.6.5.1 Spreading

Having added tone sequences to our data base, we need to look at tone spreading. According to Goldsmith (1976), automatic spreading is not the result of a phonological rule. Instead, spreading is the result of the geometry of the autosegmental representation as well as the Well-formedness Condition.

We have an example of spreading provided by Schuh (1978) from Ngizim and Duwai (Chadic languages). According to Schuh, spreading is the "extension of a **single** tone beyond its original domain" (p.230). He gives the following rule: LO HI HI → LO LO

HI. This could be interpreted in autosegmental terms, presumably as



(We recall that Schuh's paper was written prior to Goldsmith.)

If we look for such a process in Shilluk, we find that it could be reckoned as a process in some words, but could not begin to account for all of the data. Consider the following:

	Tone	Word	Gloss
(196)	L$\widehat{\text{LH}}$	àyěk	sleeping cover
	L$\widehat{\text{LH}}$	òtą̆ŋ	black animals
but			
(197)	LH	àdúθ	stinger of bee
		ɲìbɔ́:w	white calves
(198)	LM	àbɔ̄y	rotten fish

In example (196), we could posit a process of spreading. However, it would be difficult to block that spreading in examples (197) and (198). In point of fact, words like those of the second set (197 and 198) occur more frequently, and obviously are not subject to spreading.

Further evidence against spreading is seen in the following example.

	Word	Word + ání	Gloss
(199)	gą̂r	gą́:rání	northern Shilluk person

In example (199), we see a $\widehat{\text{HL}}$ contour on the citation form. When the marker *-ání* 'this' is added, the L tone from the root fails to spread to the next syllable. Not only that, the L tone is 'lost' altogether. Even though the vowel is doubled in the inflected form, the L tone still does not surface. We can see, then, that these data offer yet another argument against the idea that spreading could be implemented to account for the M tone in Shilluk.

In an earlier section, 2.6.5, we saw that Shilluk offered an argument for tone stability. Yet, in the example just presented, we see the loss of a tone, even when there is no loss of a TBU. Rather than assuming this situation to represent a case militating against tone stability, it seems more likely that there is a tone delinking rule in operation. This tone delinking rule is discussed in 5.1.4.2. The point being made by Goldsmith in relation to tone stability is that the tiers of tone and segment are somewhat independent. The evidence from Shilluk readily supports that premise. In this case, tone is delinked while the segment remains intact. In the case of the plural derivation, the tone is retained even with the loss of the TBU. Thus, the tonal tier and segmental tier are able to function independently of each other.

2.6.5.2 Assimilation Revisited

Although the status of the three tones in Shilluk has been established, there is one further point which can be made on the subject. In light of the tone sequences in Shilluk, let us look again at Assimilation. We may simply assume that the tone sequence [MH] is /LH/ underlyingly and [ML] is /HL/.

	Word	Gloss	
(200)	bā̋t	arm	/LH/ [- ¯]
(201)	cyȩ̱w	porcupines	/HL/ [- _]

However, we will have some problem distinguishing these words from those which are realized on the surface as [LH] and [HL]. See the following examples.

	Word	Gloss	
(202)	kŭl	pigs	[◡́]
(203)	bậŋ	servant	[◝]

We would have further difficulties accounting for the M tone in words which have no other surface tones nearby as in MM.

(204)	gɔ:lɔ	hook	[- -]

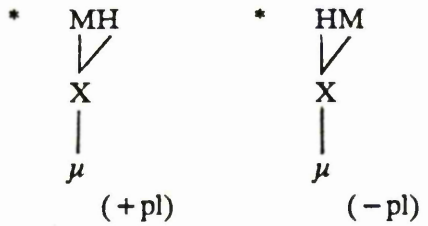
Therefore, we firmly conclude yet again that there is a M tone in Shilluk. In addition, all sequences of the three tones may occur with only a minimum of restriction. These restrictions are discussed below.

2.6.6 Singular and Plural Tones

We come now to another interesting aspect of Shilluk tonology. It seems that the number category of the noun has some influence on the tone. It was mentioned earlier that the possession marker on a singular noun regularly has a M tone whereas the same marker on a plural noun has a H tone. However, the influence of number category on tone seems to be even more far reaching than that. There are certain tone patterns which *never* occur with plural words and other tone patterns which *never* occur on singular words. Of course, the majority of patterns can occur on both. The various restrictions will be listed below with examples.

We begin with one-syllable words since they have the fewest restrictions. Actually, there seems to be only one restriction; namely, that M͡H only occurs with singular roots and H͡M only occurs with plural roots. Put in a more formal statement,

(205) Monosyllabic Root Tone Restriction (MRTR)



These tones are restricted by the number category of the noun. The examples below show what is permissible.

	Tone	Word	Gloss
(206)	M͡H	bā́t	arm
(207)	H͡M	dyɛ́ɲ	baby baskets

We move on now to words with Prefix and Root. There are several more restrictions here. We begin by looking again at the matrix that was given earlier in Section 2.6.5. Here, however, we have added the information relevant to the Singular and Plural occurrences.

(208)

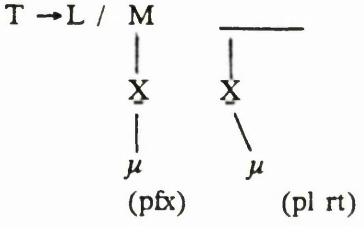
Root Tones

Prefix Tones	H	M	L	HL	LH
H	Sg	Sg/Pl	Sg/Pl	Sg/Pl	Pl
M			Pl		
L	Sg	Sg/Pl	Sg/Pl	Sg	Sg/Pl

Prefix + Root Tone Matrix

We will begin with the most general restriction; namely, when there is a M tone on the prefix of a plural noun, the root tone must be L. The formal statement is as follows.

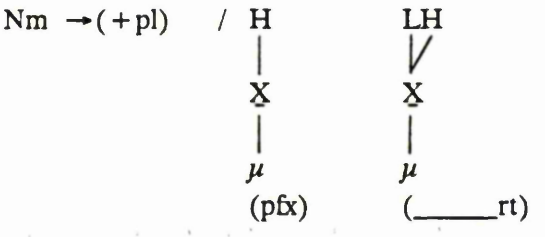
(209) L Root Tone Restriction



An example of this tone pattern is *ādwɔ̀k* 'gum trees'.

There is one other 'plural only' tone pattern in two-syllable words. That pattern is H tone on the Prefix and LH on the Root.

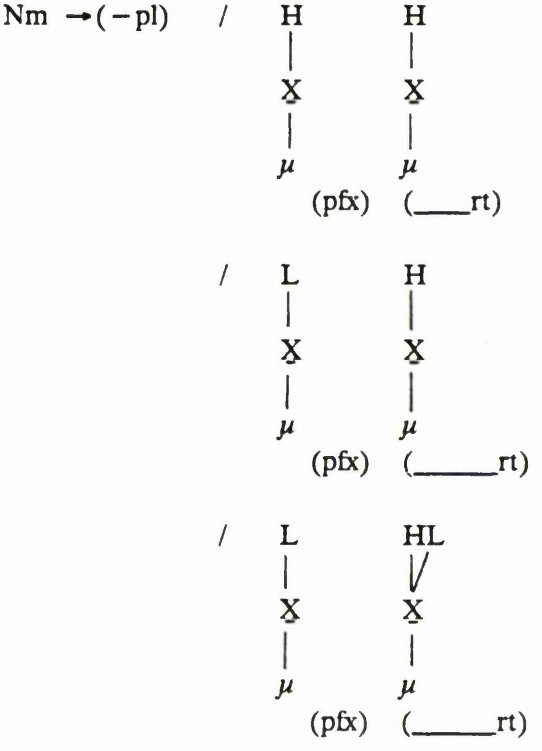
(210) Plural Tone Restriction



If the tone patterns of a noun is HL͡H, then its number category must be plural. Singular nouns may not have this tone pattern. An example is *ámăl* 'camels.'

There are three tone patterns which occur only with singular words. These patterns are: H Prefix + H Root, L Prefix + H Root and L Prefix + H͡L Root.

(211) Singular Tone Restrictions



In nouns with Prefix + Root the following tone patterns must occur only with Singular (or [−plural]) words: HH, LH, L͡H. Examples include: *álám* 'dragnet', *àđúθ* 'stinger of bee' and *àbôn* 'pastor'.

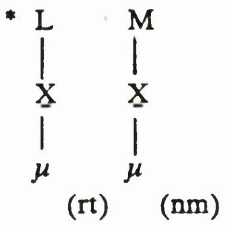
Now we will look at the Root + Suffix words. There are no number restrictions like the ones we have just been discussing on the previous words. There are, however, two sequences which do not occur; namely, M on the Root and H on the Suffix, and L on the Root with M on the Suffix. The Suffix in question here is the Number Suffix (Nm) which indicates the root's singular or plural status. The restriction does not apply when adding a morpheme such as the possession marker.

The first 'non-occurrence' is slightly suspicious. If we look at three-syllable words, we

find a sequence of LMH. This word gives us a M on the root followed by a H tone on the Nm suffix. We must suggest, then, that there is no restriction on this sequence, but that its failure to occur may simply be the result of insufficient data.

The other sequence, L+M seems to be a genuine restriction. We state it formally below.

(212) Root + Suffix Tone Restriction



This rule states that the tone sequence $\widehat{LM}$ may not occur within the noun root.

In conclusion, then, we have seen that certain tonal sequences are restricted. We have also found that certain sequences may occur only with singular or plural roots, and the remainder may occur with either. There is no explanation offered for this inter-relationship except to suggest that with such a large number of tonal options, there needs to be some limitation somewhere.

2.7 Underspecification and Tone

So far in the analysis, it has been shown that Shilluk has three level tones. But what is the best way to define the Distinctive Features with regard to tone? Hyman (1986) has reviewed the various recent proposals for handling three and four tones in terms of feature systems. Hyman seems to agree with Pulleyblank (1983) that the M tone is the unmarked one. In Hyman's interpretation (1986:115), the M tone is the "untoned" TBU while the "h" means "go up one step" and the "l" says "to down one step". Hyman then goes on to suggest multiple tiers for tone in his analysis.

For this thesis, however, I have chosen to utilize Archangeli's theory of underspecification whenever possible with respect to segments. Since Pulleyblank's analysis (1986) also incorporates underspecification, I am following his approach to tonal analysis.

Pulleyblank (1983, 1986) has argued that in a three-tone system, the M tone is the unmarked or underspecified tone. Adopting that position for Shilluk will result in the following tone matrix.

	H	M	L
High	+		
Low			+

Chart 6: Underspecified Tone Matrix

The redundancy rules would include:

(213) [+Hi] → [−Lo]DR
[+Lo] → [−Hi]DR
[ ] → [−Hi]CR
[ ] → [−Lo]CR

The fully specified tone matrix would be as follows:

	H	M	L
High	+	−	−
Low	−	−	+

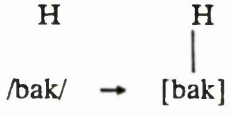
Chart 7: Fully Specified Tone Matrix

2.8 Principles of Association

In this final section, we will begin to consider how the tonal and segmental tiers are associated. First, let us consider the Obligatory Contour Principle (OCP) proposed originally by Leben (1971). The OCP excludes the possibility of adjacent autosegments having the same value. In later works, however, many problems have arisen over OCP as a universal principle. Van der Hulst and Smith (1985a:16) suggest that OCP is reduced to a principle "that *allows* one to collapse identical autosegments" unless there is some reason for them to be kept separate. In Shilluk, there do not appear to be any counterexamples to the OCP with respect to tone. Once we have established the sequences allowed in the autosegmental tier, we can relate the tonal tier, in this case, to the segmental tier by means of association lines. The conditions for association were given in Chapter One and will not be repeated here.

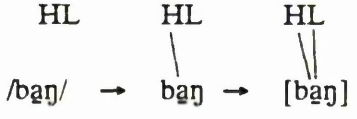
Shilluk seems to make use of all three of these associating conventions. First, we see a one-to-one correspondence in a word like *bák* 'garden.' The H tone is associated with the word. The association line is drawn from the tone to the TBU which, in Shilluk, is always a vowel.

(214)



When there are more tones than TBU's, the remaining tone is associated to the nearest TBU. In the case of *bâŋ* 'servant' we would be able to account for the tones in the following way.

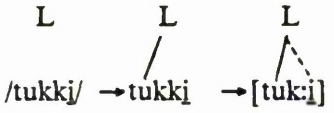
(215)



The HL is assigned to the word. The first tone is associated with the TBU. The remaining L tone is associated by 'dumping' it on to the same TBU.

In the event that there are more segments than tones, spreading occurs. Below is an example.

(216)



In this example, the L tone is assigned to the word. The first association is made to the leftmost TBU. With no further tones, the tone is spread to the rest of the word.

What has been presented here is only a basic overview of the tone analysis. It is not intended to deal with all of the problems of Shilluk tone. Those problems and their solutions are covered in more detail in Chapter Five.

2.9 Conclusion

In our discussion, we have investigated various ways in which three pitch levels might be accounted for by means of two underlying tones (H and L). We saw that Assimilation, Dissimilation and Upstep failed to adequately account for the data. Finally, when comparing the characteristics of a M tone with a !H, we found that all four points agreed that Shilluk has a M tone rather than a !H. For the remainder of this thesis, then, we will assume three level tones, H,M,L.

We also saw the large variety of tone sequences which are allowed in Shilluk. There are some restrictions on tone sequences which are related to the number category. These restrictions were listed and discussed.

Finally, the procedures for associating the autosegmental tier to the timing tier were discussed.

ABBREVIATIONS

DHSR	(96)	Diphthong High Spreading Rule
GVC	(80)	Glide and Vowel Constraint
IAR	(91)	Intervocalic Aspiration Rule
ICS	(78)	Initial Consonant Sequence
ICSC	(79)	Initial Consonant Sequence Constraint
IGCC	(90)	Initial Geminate Consonant Constraint
OHSR	(96)	Off-glide High Spreading Rule
PSR	(82)	Phonetic Shortening Rule
SFD	(85)	Syllable-Final Devoicing
TR	(81)	Tensing Rule
TVR	(89)	Tense-Voicing Rule

FOOTNOTES

[1] The unfamiliar underscore diacritic for some vocoids is the symbol used to indicate Expanded Pharynx. See Section 2.1.5.

[2] The (ˌ) indicates a fortis production of this phone.

[3] The [y] symbol represents the palatal glide, not the front rounded close vowel as per the IPA.

[4] The [ɾ̆] and [ɾ̄] represent the flapped and trilled vibrants, respectively.

[5] The [Api] or dental /t̪/ and /d̪/ will be written as /θ/ and /ɖ/. It is not intended to imply that /θ,ɖ/ are fricatives. They are dental plosives.

[6] Different speakers have unconsciously demonstrated the phonetic qualities of double or geminate plosives. One speaker insisted the correct pronunciation of 'his hooves' was [dàt.té] while another said [dà.tʰé]. The dot (.) indicates a syllable break. The [t.t] was pronounced as [tː]. When a double consonant was written, all parties expressed enthusiastic approval.

[7] In her paper, Coates used [yː] and [wː] to indicate 'strong' consonants. In personal communication, she confirmed that 'strong' consonants are fortis productions and that the colon does not indicate length.

CHAPTER THREE

THE REPRESENTATION OF LEXICAL ITEMS

> Among the tantalizing experiences in the world of linguistic investigation, the study of Shilluk must surely rank high. The apparent absence of methodical "grammar" and the relative ease with which beginners can pick up a smattering, are factors which at first invite and then bemuse the serious investigator (Tucker, 1955:421).

3.1 Synopsis of Relevant Syntax

We begin our discussion of Shilluk morphology with a brief synopsis of the syntax of nouns and verbs. This section has been included in order to establish the syntactic terminology which will be used throughout the remainder of this thesis. It is not intended to be a definitive statement of Shilluk syntax. That topic is not within the scope of this thesis, and much research needs to be done to adequately account for the complexities of the system.

After defining our terminology, we will turn to a consideration of the typical components of a word. We will examine the prefixes and suffixes and their role in the 'word'. Compound words will also be discussed briefly. Then, we will move on to the main topic of the chapter; namely, the representation of lexical items.

3.1.1 Nominal System

With respect to the category of number, Shilluk nouns do not divide simply into singulars and plurals. Instead, it is appropriate to speak of morphologically marked and unmarked forms. However, these marked and unmarked forms do not correlate with semantic singular and plural. Instead, there needs to be a category which is neutral to number, in which to place the unmarked words. Examples are shown below.

	Neutral	Gloss
(1)	yę̱p	tail
(2)	ɲâŋ	crocodile
(3)	byél	millet (collective)
(4)	wâr	shoes

In examples (1) and (2), the neutral forms are semantically singular. In examples (3) and (4), they are collective and plural respectively.

For contrast, we will now look at the marked forms of these words. The marked forms generally have suffixes to identify whether they are singular or plural. The -ɔ suffix indicates singularity, while plurality is shown either by an -i or by a long root vowel. (A more complete explanation of the long vowel appears in Chapter Four.) Let us look at the neutral forms along with the singulative and plural ones.

	Singulative	Neutral	Plural	Gloss
(5)	————	yɛ̱p	yɛ̱:p	tail/s
(6)	————	ɲâŋ	ɲáŋ:ī	crocodile/s
(7)	byɛ̀:lɔ́	byél	————	a piece of/millet
(8)	wà:rɔ̀	wâr	————	shoe/s

In order to complete the system, we need to add a third set. In the third set, there is a Singulative (Sglt) and a Plural (Pl), but *no* neutral form. In other words, both forms are morphologically marked. Examples are shown in (9) and (10) below.

	Sglt	Neutral	Plural	Gloss
(9)	àdè:rɔ̀	————	àdè:r	donkey/s
(10)	ácùŋɔ̱́	————	ácûŋ:ì	type of termite/s

In conclusion, then, we have seen that there are three noun sets in Shilluk. Set 1 has a neutral form which happens to be singular while the morphologically marked form is a plural. In Set 2, the neutral form seems to function semantically as a Collective or 'plural' and has a 'singulative' counterpart. Set 3 words, which follow many of the rules to be given for Set 2 words, have Number markers on both forms. The two members of this Set 3 are 'singulative' and 'plural'; no neutral form is found in this set. Thus:

	Marked	Unmarked	Marked
Set 1	————	Neutral (Sg)	Plural
Set 2	Singulative	Neutral(Coll)	————
Set 3	Singulative	————	Plural

For the purposes of this thesis, the 'Singular' neutral form will be termed 'Singular' (Sg). The 'Plural' words in the neutral category will be called 'Collectives' (Coll). In this way, they will not be confused with each other (which would happen if only the morphologically based label 'Neutral' was used.). They will also be distinct from their marked counterparts (i.e., Singulative (Sglt) and Plural (Pl)).

It is worth noting that there is no subject/verb agreement which would signal singular or plural. Furthermore, only indefinite nouns are indicated by *ki*, which can translate as 'a' or 'some' depending on the noun which follows it. Definiteness is not indicated overtly. It is the default value. Singularity or Plurality can only be expressed syntactically if a quantifier is used or if the noun is modified by one of the few adjectives which happen to have a singular or plural form. Most adjectives have only one form which can be used with either singular or plural nouns.

There is further evidence for setting up the three noun sets described above. Consider nouns which are in a genitive relationship with another noun, or a determiner.

Set 1	Sg	Pl	Gloss
(13)	bul gɔn	bul:i gɔn	his drum/s
(14)	kwey wɔn	kwey:i wɔn	our grandfather/s
(15)	ɔd gwet	ɔt:i gwe:t	house/s of writing

Set 2	Sglt	Coll	Gloss
(16)	wi:ni ɗɔ ŋu:	wi:n ɗɔ ŋu:	lion's whisker/s
(17)	yɛ:yi ŋu:	yɛ:y ŋu:	lion's hair/s
(18)	wiyi gen	wɛ:k gen	their father/s

Set 3	Sglt	Pl	Gloss
(19)	apwɔɲ:i gɔn	apwɔc:i gɔn	his rabbit/s

The relative order for the genitive construction is Possessed (Psd) + Possessor (Psr). Note that in Set 1, the Plural form has Psd+i+Psr. In Set 2, the Sglt form has the same Psd+i+Psr construction. When we look at Set 3, we see that *both* forms have the -i possession marker. Notice further that in the Sg and Coll (i.e., unmarked) forms there is no such possession marker.

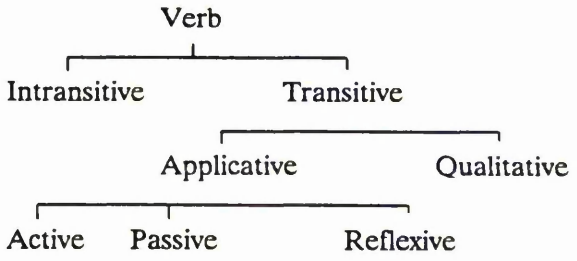
Since the -i possessive marker may occur with what are semantically singular (i.e., Singulatives) as well as plural forms, and in some cases with both, we would be at a loss as to how to predict its distribution. However, if we operate with the dichotomy of morphologically unmarked versus marked forms, we can readily state that the -i possessive marker occurs with non-neutral forms. Thus, we see that there is independent confirmation that our marked/unmarked dichotomy is of value.

3.1.2 Verbal System

Both Kohnen (1933) and Tucker (1955) have attempted to classify Shilluk verbs. We will look at their observations and explanations of the data so that we are aware of the issues at hand. No attempt will be made to prove one view over another as we will simply be trying to define terms which more adequately reflect the syntactic usage of the various verb forms found in the data base.

3.1.2.1 Kohnen's view

Kohnen (1933) has given a classification of Shilluk verbs. His diagram of this classification is shown below.



We see that he divides verbs into Transitive and Intransitive. Kohnen does not define Intransitive, but does give examples such as *ya catho* "I walk ".

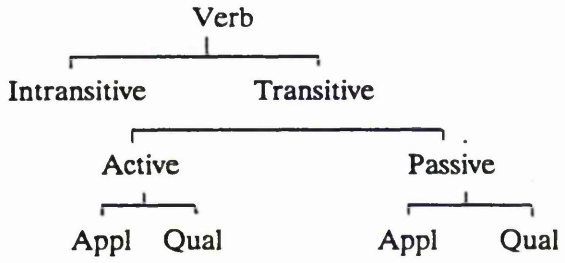
Next, he divides Transitive into Applicative or Qualitative. According to Kohnen, an Applicative form "rules a direct, determinate, actual, present object ". The Qualitative form "has no direct, determinate accusative object " (p.123). He cites the following examples.

	Clause	Gloss	
(20)	ya thala riŋani.	I cook this meat.	(App)
(21)	ya tado	I am cooking	(Qual) (p.123)

Kohnen further subdivides the Applicative into Active, Passive and Reflexive. I have not investigated the Reflexive; so it will not receive any further attention.

3.1.2.2 Tucker's view

Tucker (1955) does not diagram his system *per se*, but from his description it would probably be as follows:



He divides the Transitive verb forms into Active and Passive.

	Clause	Gloss	
(22)	yá gɔca gwòk	I am beating the dog	(Act)
(23)	yán a gôc (yì ŋati)	I am being beaten (by someone) (p.432)	(Pass)

He then treats Applicative and Qualitative as subdivisions within each voice. The Applicative has a specific object (for Active) or agent (for Passive) which is mentioned or understood, as in the examples above.

A Qualitative form refers to a verb "without reference to an object or noun agent, or applying to it only in a general sense" (p.432). Further, he says that an Intransitive verb "may be said to conjugate as a Qualitative verb.". This raises the question of how he would distinguish between Intransitive and Qualitative. Tucker does not address that question. Some of his examples are:

	Clause	Gloss
(24)	yâ· gòcò	I am beating (Act)
(25)	yâ· gɔ̀ɔ̀jɔ̀	I am being beaten (Pass)
(26)	ya kɛdhɔ	I go (Intran)
(27)	ya dɔɔgɔ	I return (Intran) (pp.432,447,449)

It is interesting to note that the 'Passive' is considered to be more common than the 'Active'. According to Tucker (1955), the passive is "on the whole more in use than 'the Active' in everyday conversation" (p.432). Kohnen (1933) makes a similar comment, "Shilluks preferably make use of the passive voice of the transitive verbs, particularly in the *future* and *past* tenses indicative and in the conditional mood" (p.133). Finally, Westermann's comment (1912:78) expresses an honest view of the difficulty in even

hearing the changes between the voices when he says,

> Most foreigners have considerable difficulties in distinguishing the active voice from the passive, the difference between both lying in most cases solely in the intonation . . . the natives prefer to speak in the passive voice; therefore, the foreigner can best avoid misunderstandings by using the passive voice as much as possible and by supposing that what a native tells him, to be passive, and not active.

3.1.2.3 Terms Employed in Describing Related Languages

Okoth-Okombo (1982) states that in Dholuo, the Intransitive verb has two forms. One form refers to action with no logical object as in *nind–* 'to sleep'. This form is called 'Intransitive'. The second form, considered as Qualitative is an action in which the object is understood but not expressed. An example of a Qualitative verb is *meθo* 'to drink'.

For Turkana, Dimmendaal (1983) reports that an Intransitive verb has one noun phrase as the subject with a nominative case marking. Transitive verbs have both a subject and a direct object. The third type is an Impersonal Active from which a Subject NP is absent. This third type probably corresponds to the 'Passive' in Shilluk. He does not describe anything that seems to correspond to the Qualitative verbs in Shilluk as discussed by both Kohnen and Tucker.

Reh (1986) discusses similar phenomena in Anywak. She terms the Transitive verb an 'Action Process' verb form. This term implies that both agent and patient participants are present. The Qualitative form is called a 'Patient Deleting' Derivation. In this case, the verb is an action verb which no longer allows a patient participant.

3.1.2.4 Terminology for Shilluk

3.1.2.4.1 Constituent Order

So far, none of the descriptions of Shilluk syntax seems to have dealt adequately with the data. Constituent order is such an intrinsic part of the verb system that when one tries to separate constituent order from the verb type, an incredible amount of confusion results. Unfortunately, keeping them together can be equally as confusing. However, I will take up the challenge.

The main reason for this discussion of syntax is that there are certain verb forms; namely, C-ob and C-opt, which cannot be defined within current syntactic terms. The information presented here attempts to clarify the nature of these forms.

We will begin with constituent order. An 'Active' clause will consist of the following functions: Subject (S) + Verb (Vb) + Complement (Cm). The S is expressed by an Agent (A) and the Cm may be expressed by a Patient (P), Benefactive (B), Instrument (I) or Location (Loc). The 'Passive' has the same set of constituents S + Vb + Cm. But, the S slot is expressed by a Patient (P) and the Cm slot by an Agent.

S	Vb	Cm	
A		P	'Active'

S	Vb	Cm	
P		A	'Passive'

Examples of each constituent order type are:

Active:

(28)

S/A	Vb	Cm/P	
ya	θal:a	kwạn.	'I cook the porridge.'
1ps	cook	porridge	

(29)

S/A		Vb	Cm/P	
ja:l	dwọŋ	yep:a	ɗɔ ɔt.	'The man opens the door.'
male	big	open	mouth house	

Passive:

(30)

S/P	Vb		Cm/A	
kwạn	θal	yị	yan.	'The porridge is cooked by me.'
porridge	cook	by	1ps	

(31)

S/P		Vb		Cm/A		
ɗɔ	ɔt	yep	yị	ja:l	dwọŋ.	'The door is opened
mouth	house	open	by	male	big	by the man.'

In addition to the 'Active' and 'Passive' orders, there is also a Vb + S + Cm order. This verb-initial order is never discussed by Kohnen (1933) or Tucker (1955), nor by Tucker and Bryan (1966). However, it occurs most frequently in texts and its neglect may have been due to its having been perceived as an incomplete passive. We shall refer to this order as the Narrative Constituent Order. The Verb is followed by the Subject expressing the Agent and then the Complement expressing the Patient. Both Active and Passive Voices are found with the verb-initial clauses.

VSCm Narrative Active:

(32)

Vb	S/A	Cm/P		
ayo:t	wɔ	jiy	bẹ:n	'We found all the people
pst-find	1pp	people	all	sitting.'

(33)

Vb	S/A	Cm/P		
abwɔk	jiy	keti	gen.	'The people became afraid.'
pst-fear	people	refl	3pp	

VSCm Narrative Passive:

(34)

Vb	S/P	Cm/Loc		
adɔ:k	wɔn	pa	wɔn.	'We were returned to our
pst-return	1pp	village	1pp	village.'

(35)	Vb	S/P	Cm/A		
	acyẹt:i	gen	yi	wɔn	'They were chased by us.'
	pst-chase	3pp	by	1pp	

(36)	Vb	S/P		Cm/A			
	ajo:k	wɔn	yi	jɔk	pa	ani	'We were convinced
	pst-convince	1pp	by	men	village	this	by the men of this village.

Careful examination of this VSCm order reveals some important information. First, the 'S' slot is contiguous to the verb. This same point is true of the SVCm order. Secondly, the S has no morphological marking (in particular, there is no adposition).

The examples of Passives (34 - 36) show the S/P determiner in the Objective case. (The Objective case is indicated in Shilluk by the addition of -n to the pronoun.)

Now we come to yet another ordering of constituents: VCmCm. Examples are shown in (37) - (39). In this order, there is no S. Since a S cannot have an adposition, the *yi + NP* found in the examples precludes this structure from having S status, even though it is contiguous to the verb. The second Cm cannot have S status because it is not contiguous to the verb. Therefore, we have a 'Subjectless' sentence in which we have Cm/A and Cm/P as in (39).

(37)	Vb	Cm/A			Cm/I		
	abẹ:n	yi	jạ:l	mekɔ	ki	tɔŋ.	'Another man came
	pst-come	by	man	other	with	spear	with a spear.'

(38)		Vb	Cm/A		
	ka	bẹ:n	yi	en	'When he came, ...
	when	come	by	3ps	

(39)		Vb	Cm/A	Cm/P		
	ka	ɲi-mạk:i	yi ŋu:	ki	lạ:y	'When an animal was
	when	hab catch	by lion	indef	animal	caught by the lion,'

Thus, we can contrast the SVCm, VSCm and VCmCm orders. The S in the VSCm order has no morphological marking and is contiguous to the verb. The S in the SVCm order meets the same criteria. By contrast, however, the constituent immediately following the verb in the VCmCm order has an adposition. The third constituent is not contiguous to the verb, and so cannot be assigned S status.

If we assume that the analysis so far is correct, then there should be some factor which would suggest when one construction is used instead of the other. In studying several different types of narratives, there seems to be evidence to suggest that the VCmCm order is more commonly used in narratives which are told by a third party. The VSCm pattern occurs in narratives in which the narrator is a participant in the action. More research is needed to confirm this hypothesis. For the present, then, I am suggesting that there are two verb-initial constituent orders.

(40) V Cm Cm Narrative: Narrator ≠ Participant
A X

and

V S Cm Narrative: Narrator = Participant
A X

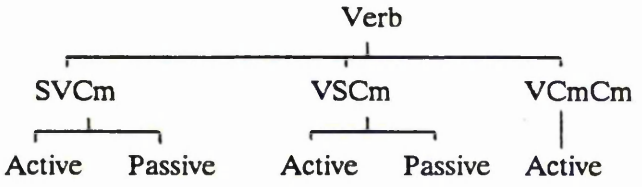
In the first order, VCmCm, the first Cm slot is filled by an Agent. The Agent, however, may not be the narrator. This slot must be filled by a yi + NP. The second Cm may be filled by Patient or Location. An 'X' is used to show that more than one type of semantic role may be expressed in this position.

The second verb-initial order, VSCm, assumes the narrator to be a participant. The S as Agent follows the verb and may be filled by any semantically appropriate NP. There is no morphological marking. The S slot *always* follows the verb. Any other NP must be considered a Complement (Cm).

The VSCm order operates with both Active and Passive Voices whereas the VCmCm order seems to only include the Active. Thus, in the VSCm order, the S may express the Agent in the active Voice or the Patient in the Passive. The Cm slot will express the Patient in the Active Voice and the Agent in the Passive. There may be other fillers, but there is insufficient data to draw further conclusions at this time.

So far, we have three constituent orders: SVCm, VSCm and VCmCm. The Active and Passive Voices can be found in the SVCm and VSCm. The VCmCm can only have the Active Voice. A diagram of this information is shown below.

(41)



Now that we have established the constituent order side of Shilluk, we need to look briefly at the Transitive and Intransitive verbs. On the clause level, the surface forms of Transitive and Intransitive verbs are identical. Consider the following examples.

Intransitive:

(42a)		S/A	Vb	Cm/Loc		
	ka	jiy	reŋ:a[1]	pa	ani.	'And people ran to
	and	people	ran	village	that	that village.'

Transitive:

(43a)	S/A	Vb	Cm/P	
	ŋu:	ca:ma	lạ:y.	'The lion eats the animals.'
	lion	eat	animals	

The first example (42a) is Intransitive and the second (43a) is Transitive. In the SVCm order, the -a is obligatory if there is a Cm slot. In the examples, the Cm may be expressed by either a Locative or a Patient. The only way to identify an Intransitive verb

by some means other than semantic content is to find the active verb form without a Cm. In such a case, the Intransitive verb root will be *identical* to the root of that verb with a Cm. If the verb is Transitive, there will be a difference in the stem between the +Cm and −Cm forms.

Intransitive:

(42b)		S/A	Vb	
	ka	jiy	reŋ[1].	'And the people run.'
	and	people	run	

Transitive:

(43b)	S/A	Vb	
	ŋu:	cyạ:m.	'The lion eats.'
	lion	eat	

We see that *reŋ*[1], an Intransitive verb, has the same root whether or not a Locative is mentioned. However, with the Transitive root, there is *ca.m* with the Patient and *cyạ.m* without the Patient. Often the distinction in these forms lies in the initial consonant and the [Ex] feature of the vowel.

We have now seen one of the paradoxes in Shilluk syntax. Transitive and Intransitive verbs are distinctly different on one hand, but behave very similarly on the other. To handle them separately ignores the obviously large overlap. To deal with them together could imply that they are identical. In order to avoid these extremes, I shall refer to a category of 'Transitive' (in inverted commas). This 'Transitive' category will include both Transitive and Intransitive verbs, but will hopefully signal to the reader that I am using this term in a broader sense than it normally conveys. Thus, I can describe the generalities of the system without unnecessary redundancy.

Now, let us quickly review what we know about Shilluk verbs to this point. First, there are three constituent orders: SVCm, VSCm, and VCmCm. The SVCm and VSCm may have Active or Passive Voices. Only the Active Voice may apply to the VCmCm order. The S expresses the Agent in the Active while in the 'Passive' the S expresses the Patient.

In the VSCm type, the narrator is a participant in the event. This consideration employs a morphologically unmarked NP to act as S/A. In other third party discourses, the Agent in the post-verb position is always indicated by *yi* + NP. The second constituent cannot be S in this case, since S's cannot be filled by an adposition phrase in Shilluk. Thus, we have the VCmCm type of Narrative.

Finally, we are using 'Transitive' (in inverted commas) to indicate both Transitive and Intransitive verbs in order to capture the generalizations between these two types of verbs.

3.1.2.4.2 Complements

Now we come to one of the most 'tantalizing' aspects of Shilluk syntax; Complements. This area of the verb system seems, at face value, to be fairly straightforward. The language learner soon catches onto the gist of things, even though it is difficult to express in words. Kohnen called these verb forms 'Qualitative', probably for lack of any other more enlightening terminology. His lead has been faithfully

followed by others, until recently. In an earlier version of this thesis, I had thought of using the terms Complement vs Non-Complement to describe the situation. However, it soon became apparent that this terminology did not adequately account for the data. The summary given here is far from a satisfactory account. However, I shall try to present the data as it is currently understood and attach some label to it. At least then it can be discussed, even if it is not fully understood.

Let us begin with the 'Active' version of the SVCm order. The Cm in this case is marked by -a suffixed to the verb. See the example below.

(44)	S/A		Vb	Cm/P	
	ɗeŋ	dwɔŋ	aθal:a	riŋɔ.	'The woman cooked the meat.'
	female	big	pst-cook	meat	

In this sentence, the Cm is expressed by a Patient. However, if the Cm were not included, the result would not be **deŋ dwɔŋ aθal.* Instead, there is a change of verb root.

(45)	S/A		Vb	
	ɗeŋ	dwɔŋ	ata:t.	'The woman cooked.'
	female	big	pst-cook	

In English, there is a similar sort of situation syntactically. If we take Transitive verbs such as 'eat, drink' or 'read', we can say:

(46)			
	I eat food.	or	I eat.
	I drink water.	or	I drink.
	I read a book.	or	I read.

The first clause is a transitive clause. The second is an uncomplemented form which Lyons (1971:252) describes as a 'pseudo-intransitive'. In this case, the object is not present, but may be contextually determined and may be recovered by semantic interpretation. This approach may be applied to Shilluk in a broader way. Instead of there being a handful of transitive verbs which have 'pseudo-intransitive' counterparts, almost all transitive verbs in Shilluk have a 'pseudo-intransitive' form.

It might be hypothesized that 'pseudo-intransitives' were thought to be derived from transitive verbs. However, it will be shown that this idea will not work for Shilluk. In fact the non-derivability of the Shilluk forms could be taken as evidence for claiming that pseudo-intransitives are never "derived" structures in syntax. It will be shown later in this chapter that the transitive and pseudo-intransitive (or 'C-ob' and 'C-opt', as they will be termed later) are related, but synchronically underivable.

If we look more closely at the two possible verb forms in Shilluk, we see that in order to keep verb form 1, there must be a Complement. Form 2 has no complement. For this reason, a Complement (Cm) / Non-Complement (N – Cm) dichotomy seemed appropriate.

It soon became clear, however, that this distinction was not the best. The 'N – Cm' verbs can, in fact, take two complements: the Benefactive and the Instrument. Consider these examples.

(47)	ɲan θi̱ṉ aθal:a gincam.	'The girl cooked food.'
(48)	ɲan θi̱ṉ ata̱:t.	'The girl cooked.'
(49)	ɲan θi̱ṉ ata̱t:i̱ meye.	'The girl cooked for her mother.'
(50)	ɲan θi̱ṉ ata̱:da dak.	'The girl cooked with a pot.'

The verb 'to cook' [θal/ta̱:t] is illustrated here because the occurence of suppletive forms makes the change more obvious. Other verbs which are not suppletive do change in similar fashion, but the change is less striking. For example:

(51)	ya yep:a ɗɔ ɔt.	'I opened the door.'
(52)	ya ye̱:p.	'I opened.'
(53)	ya ye̱p:i̱ meya.	'I opened (it) for my mother.'
(54)	ya ye̱:ba tɔŋ.	'I opened (it) with a spear.'

Further examination revealed that the distinction was not one of the presence or absence of the Cm. Instead, it seemed that perhaps optionality was the deciding factor and thus terms such as Cm-obligatory (C-ob) or Cm-optional (C-opt) were preferable. Thus, the C-ob verb form requires a complement while a C-opt verb form may or may not have a Complement.[2]

We began this section with the Active SVCm, and based our analysis on that. If, however, we look at the Passive version of the SVCm, we find our second problem. The verb form of the Passive is the same one as for the Active. The Complement/Agent, however, is optional. Note the examples below.

(55)	kwa̱n áθal yi̱ yan.	'The porridge was cooked by me.'
(56)	kwa̱n áθal.	'The porridge was cooked.'

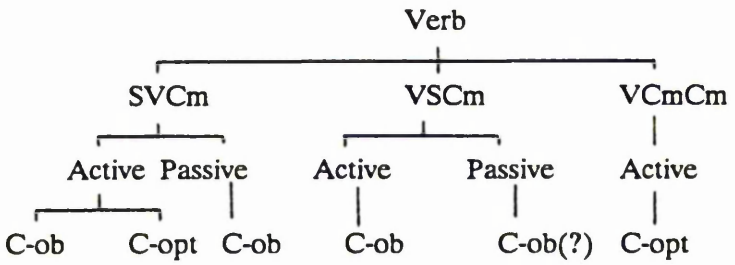
In most cases, the Agent is known from the context, and so the speaker does not bother to include this redundant information. The problem, then, is that in the case of the Passive, the C-ob verb form has an optional Cm component.

Fortunately, this situation is not totally unprecedented. Lyons (1971:378) states that all languages with passives have one thing in common — agentless sentences such as 'Bill was killed'. Since this phenomenon is not uncommon in the world's languages, C-ob can be redefined to allow for the Passive construction to have an optional Cm/A.

The Narrative orders described above have been a recent discovery, and it is not clear how all of these facts fit into the C-ob/C-opt system. The VCmCm takes the C-opt verb form. The Active forms of the VSCm takes the C-ob. It appears that the Passive form also takes the C-ob, but further investigation is needed to confirm this. As to inclusion or exclusion of Cm's, that will have to be studied at a later time.

3.1.2.4.3 Conclusion

In 3.1.2.4.1, I began a diagram of the constituent orders of Shilluk verbs. Based on the discussion of Complements, that diagram can now be completed.

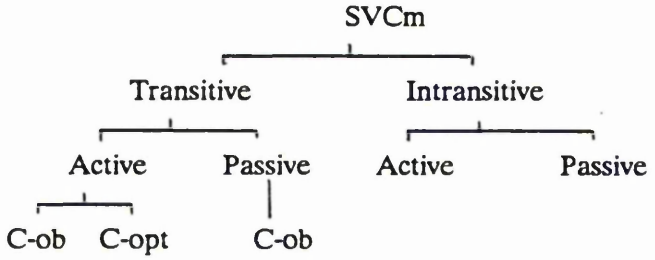


In both orders which have the S function, it is also possible to express both Active and Passive Voice. The VCmCm order can only express the Active Voice.

Both voices in the VSCm order *seem* to use the C-ob form of the verb. Further investigation needs to be done on this point as I am not completely sure which form is used in the Passive.

In the SVCm, the verb in the Passive Voice takes the C-ob form. In the Active Voice, there is a choice. If there is a Cm slot, then the C-ob is chosen. If there is no Cm slot, then the C-opt form is utilized. Other uses of the C-opt form have been noted. We have seen, then, that Shilluk has both 'Subjectless' sentences and 'Complementless' sentences.

Finally, the Transitive and Intransitive verbs can be identified structurally. The Intransitive verbs have only one verb form which can be [± Cm]. Transitive verbs, on the other hand, have one form of the verb for [+ Cm] and another, underivable, but related form for [− Cm]. A diagram of this relationship is shown below.



3.1.3 Word Structure

Shilluk words may be from one- to four-syllables in length. Four-syllable words are usually compound words and they occur only rarely. It seems that the trend in Western Nilotic languages is to become monosyllabic wherever possible by incorporating affixes into the root (i.e., without loss of information). We will discuss roots in the next chapter. For now, we shall concentrate on the affixes still remaining in the language.

3.1.3.1 Nouns

3.1.3.1.1 Prefixes

The most common noun prefixes are *a-*, *o-*, *ɲa-* and *ɲi-*. These may at one time have been gender markers. They are frequently used in names to distinguish male and female and 'young' or 'child '.

Personal Names

	Male
(57)	oθɔw
(58)	okoɲ[3]

	Female
(59)	ɲaθɔw
(60)	ɲalam

Cow Names

	Bull	Cow	Calf	Color/Description
(61)	obyɐ̲c	abyɐ̲c	ɲibyɐ̲c	extra long horns
(62)	diduk	aduk	ɲiduk	dark grey

In these examples, it appears that the o- prefix is a masculine gender marker. The ɲi- or ɲa- is a feminine marker. The a- could also be assumed to be a feminine marker for animals. However, the system, if indeed there ever was one, is no longer productive as we see from these examples.

Personal Names

	Male	Female	Male or Female
(63)	awul	apar	aywɔk
(64)	ajak	abuk	akwɔt
(65)	awer	ayaθ	amum

Cow Names

	Bull	Cow	Calf	Color/Description
(66)	ɲibɔŋ	obɔw	ɲibɔw	white one
(67)	dila:l	ola:lɔ	ɲila:lɔ	red
(68)	dita̲ŋ	ota̲:ŋ̲ɔ̲	ɲita̲:ŋ̲ɔ̲	black
(69)	ocwɔ̲t	cwɔ̲t	ɲicwɔ̲t	without horns

We see that now the a- prefix may occur before names of men or women. So, the assumption we had about a- turns out to be unfounded. The gender classification does not carry over into cow names since ɲi-, which is normally associated with calves or young bovines may also identify not the cow name, but the bull name. Even the o- has become associated with both male and female animals. Therefore, we must conclude that the prefixes no longer have a productive role with regard to gender.

Prefixes appear to have been added to nouns simply as formatives to create other nouns. See the examples below.

	Word	Gloss	Formative	Gloss
(70)	gwɔ̲k	dog	ógwɔ̄k	jackal
(71)	bul	to mend	àbùl	a patch
(72)	lwɛ̆:dɔ̄	finger	álwɛ̆:dɔ̄	crab
(73)	àdè:rɔ̀	donkey	òdyèrɔ̀	zebra
(74)	ɲâŋ	crocodile	ɲáɲâŋ	type of lizard

There are also less common prefixes which perform this same function including *θa-*, *ba-*, and *di-*.

	Word 1	Gloss	Word 2	Gloss
(75)	pīn	wasp	*θ*ápīn	hornet
(76)	jwan	to hurry	bājwân	Name meaning 'do not hurry'
(77)	cay	to punish	bàcáy	Name meaning 'not to be punished'
(78)	kɔmɔ	behind	dikɔmɔ	back (part of body)

3.1.3.1.2 Compounds

Compound words are often composed of a prefix and two nouns, or a prefix and a verb and a noun. There are many possibilities. Only a few examples are given here. One example is the word for 'butterfly' shown in (79) below.

(79) adẹ̲:ljwɔk 'butterfly'

'Something/one that' seems to be the meaning of *a-*. The word *dẹ̲:l* means 'skin' and *jwɔk* means 'God'; so a 'butterfly' has skin (that is so delicate that it is) like God's skin.

Another example is the word *aŋɔkrɔw* which literally means 'something that vomits itself'. This is the word for 'chameleon'.

3.1.3.1.3 Suffixes

In Section (3.1.1), we saw that -ɔ typically marks the Singulative while -i or a long root vowel marks the plural. There are also possessive suffixes:

(80)	Sg	Pl	Gloss
	-a	-wan (inclusive) -wɔn (exclusive)	1st person
	-i	-wun	2nd person
	-e, gɔn	-gen	3rd person

When a possessed noun is singular, the tone on the possessive suffix is M. If the possessed item is plural, then the possessive suffix has a H tone. Below is an example of the alternation of tone with the pronoun 'my'.

(81) pà̲:mā 'my sawn timber'
(82) pá̲m:á 'my sawn timbers'

There is also a referential determiner *-ání* which means 'this'. It is used as a marker in the discourse to identify the topic or major participant in a narrative. The word *men* 'this' is used as the demonstrative.

3.1.3.2 Verbs

3.1.3.2.1 Prefixes

Tense markers are prefixed to verb roots. The á- prefix generally indicates the past tense and has a high tone.

(83) ɲel θi̱ṉ árēŋā gàt. 'The boy ran to the river.'

The o- prefix usually indicates present or future tense. The tone of the prefix is affected by constituent order; so that the Present tense o- has a M tone in the Active Voice of the SVCm order and a L tone in the Passive Voice of the SVCm order. There is a H tone in the future tense of the Active Voice of the SVCm.

SVC Act
(84) jal dwɔ̱ŋ ōgwē̱:jɔ̱̄. 'The man clears (the field).'
SV Pass
(85) pwɔ̱:dɔ̱ ògwè:jɔ̀. 'The field is being cleared.'
SV C-opt
(86) jal dwɔ̱ŋ ógwè̱:jɔ̱́. 'The man will clear (the field).'

The prefix ɲi- is an habitual marker.

(87) jalání ɲicam:a ri̱ŋɔ̱. 'This man always eats meat.'

In the event that both past tense and aspect occur together, the tense marker precedes the aspect marker as *á-ɲi-* in the following sentence.

(88) gi̱k áɲigɔk:i yi̱ en. 'Things were habitually done by him.'

3.1.3.2.2 Suffixes

There are three suffixes which may occur with verbs. The -a suffix follows the verb in SVCm Active.

(89) deɲ dwɔ̱ŋ áθal:a ri̱ŋɔ̱. 'The woman cooked the meat.'

An -ɔ suffix often occurs with C-opt forms. There is also an -i suffix which occurs with these and other verbs. The functions of these suffixes are unclear at this time.

Kohnen's explanation of the -i emphasizes that there is a difference betwen the shortened *yi* → *i̱* meaning 'by' which follows the verb and the suffix -i. He lists three possible uses of the -i suffix: 1) direct object pronominal suffix, 2) final vowel of the past tense of some intransitive verbs, 3) the subject (personal pronouns, suffix 2nd person singular) in subjunctive sentences when the subject follows the verb (1933:137).

The -ɔ suffix, according to Kohnen (1933:124), is added to all Qualitative (C-opt) forms in the present and futures tenses, but is dropped in the past tense. The -ɔ also is added to the Applicative (C-ob) form to make a passive in the present tense, but is

dropped in the future and past tenses. From examples (91) and (92) below, it can be seen that both suffixes are used, and no difference in meaning is readily apparent. More work needs to be done in this area. The -i does appear consistently with the Benefactive verb form which is derived from the C-opt form. Examples of the -ɔ and -i suffixes are shown below.

(90)	jal dwɔŋ ɔ̱gwɛ̱:jɔ̱.	'The man clears (the field).'
(91)	jalání ɔ̱cwɔ̱t:ì.	'The man calls.'
(92)	jalání ɔ̱cwɔ̱t:ɔ̱.	'The man calls.'
(93)	ya tɑ̱t:í mea.	'I cook for my mother.'

3.2 Lexical Items

In this section we will be considering the morphophonology of the nominal system of Shilluk as well as the verbal system, though to a lesser extent. The various grammars written about Shilluk have tried to explain the system of singulars and plurals. However, the discussion rapidly deteriorates to a listing of the 'irregularites' of the 'system'. The end result for the language learner is to be left in virtual chaos. It would seem that this problem extends across most Nilotic languages as can be seen from this comment made about the nominal system of Dholuo. The instructions for learning nouns go as follows:

> Although certain rules do exist, governing the formation of the plural of nouns, there are also numerous irregularities. Because of this difficulty, the student will do well, if when learning the singular form of the noun, he also memorizes the plural form 1. This will prove extremely helpful in the beginning, whilst one is gradually becoming acquainted with the rules governing the regular nouns (Anon., 1935).

A similar word of caution is brought by Fr. Kohnen in his Shilluk Grammar when he says "A general rule for the formation of Plurals in Shilluk cannot be given. Practically one has to learn the plural of nouns from the dictionary...below (are) some practical guidelines" (Kohnen, 1933:19). He then goes on to list about fifteen ways to form a plural in Shilluk.

The conclusions reached in this chapter will, in a sense, only confirm what Kohnen and others have said. In fact, it will go much further and claim that each noun has two Underlying Representations, one for singular and another for plural. Neither form can be successfully derived from the other. Extensive evidence will be given in this chapter to support this claim, with further evidence offered in Chapter Four. While most of this section will deal with nouns, we will also consider the C-ob and C-opt forms of the verb. We will see that the same principles apply to both nouns and verbs. Thus, our conclusions will also apply to both the nominal and verbal systems.

3.2.1 Points of Consistency

We will begin our study by looking for points of similarity between forms. The first point, word shape, will deal primarily with nouns. Verbs have aspect and tense prefixes, and clearly these do not function in the same way as nominal prefixes. Any verb may

have tense/aspect markers, but the lexical meaning of the verb itself is unchanged. However, the addition of a prefix to a noun root may change the semantic meaning.

3.2.1.1 Word Shape

Earlier, in Section 3.1.3.1, we saw how the addition of a nominal prefix changed the meaning of the word. The word shape, with regard to the prefix and the root of a particular word, will remain consistent in both the singular and plural forms. See the examples below.

	Singular	Plural	Gloss
(94)	gwo̱k	gwo̱:k	dog/s
(95)	ógwɔ̄k	ógɔ̄:kì	jackal/s
(96)	lwɛ̄:dɔ̄	lwêt	finger/s
(97)	álwɛ̄:dɔ̄	álwêt	crab/s

We see that if there is a prefix in the singular, there is also one in the plural. When speaking of word shape, I am referring *only* to the presence or absence of a prefix with the root. The end of the word is less consistent in shape.

3.2.1.2 Initial Root Consonant

The second point of consistency has to do with the root itself. The root of a Shilluk word has a shape C_1VC_2. We understand that the C_1 may be a sequence of a consonant + glide or simply a single C. In most instances, the singular and plural forms will have the same C_1. See the examples given below.

	Singular	Plural	Gloss
(98)	bɛ̀lɔ̀	bɛ̄l	taste/s
(99)	byè:rɔ̀	byɛ̄r	root/s
(100)	gûr	gù:r	Nile Perch/es
(101)	gyɛ̀k	gyɛ̀:k	Nile Lechwe/s

The same generalization holds in the verb root between the C-ob and C-opt forms.

	C-ob	C-opt	Gloss
(102)	kak	ka̱:k	split
(103)	kwa:n	kwa̱:n	count
(104)	cak	ca̱k:i̱	start
(105)	cwak	cwa̱k:i̱	support
(106)	cya̱k	cya̱k:i̱	name

The reader may have noticed a slight change in the tenor of the language used between the first and second points just discussed. The first point is consistent in all cases, except, of course, suppletive forms. The second point, having to do with the C_1, is consistent *in most instances*. In other words, there are cases where there are exceptions. In the next two points, this same assumption is necessary. The points of similarity are the general rule. However, there are fairly frequent exceptions to them which will be

discussed in the section on differences. We continue now with points of consistency with respect to the C_2 of the stem.

3.2.1.3 Final Root Consonant

The C_2 of the root is generally the same phoneme in both forms of the word. Look again at the examples given in (98) to (106). The C_2 may be doubled, or geminate intervocalically as in (104) to (106). However, the segment is the same in both forms. There is a difference in voicing with the plosives, but underlyingly, they can be shown to be the same segment. The various rules dealing with voicing in plosives have been covered in Chapter Two.

3.2.1.4 Root Vowel

Finally, we look at the root vowel. In order to discuss the vowel, a convention needs to be proposed. In most cases, [Ex] does not correlate with changes in vowel height. The only exception to that is the [o] which is [−Ex] and the [u] which is [+Ex]. For the purposes of this discussion, I will identify [o] as a [+Hi,−Ex] vowel and the [u] as [+Hi,+Ex]. This convention will allow us to discuss 'vowel height' without having to constantly account for the vowel height which is directly related to the [Ex] feature.

Let us look now at the 'vowel height' as it occurs in the root (i.e., I,E,A,Ɔ,O). We find that the 'vowel height' is usually the same in both forms. Here, and throughout the thesis, upper case letters will be used to identify segments which are not fully specified for a feature, such as [Ex] in the case of vowels. Now, consider the following words.

	Singular		Plural	Gloss
(107)	/I/	cìŋɔ̀	cíŋ	hand/s
(108)	/E/	àdè:rɔ̀	àdè:r	donkey/s
(109)	/A/	bâŋ	bâ:ŋ	servant/s
(110)	/Ɔ/	ápwɔ̀:jɔ̀	ápwɔ̂c:ì	rabbit/s
(111)	/O/	gûr	gù:r	Nile Perch/es

		C-ob	C-opt	Gloss
(112)	/I/	liθ	liθ:i	see
(113)	/E/	gwɛc	gwɛ:c	clear a field
(114)	/A/	bak	ba:k	guess
(115)	/Ɔ/	cɔŋ	cɔ:ŋ	dance
(116)	/O/	cok	cok	stop on the way

We see that the 'vowel heights' are the same in both forms. It does not take long, however, to see that there are differences in length and in the feature [Expanded]. We will look at these as we discuss the differences between forms.

3.2.2 Points of Variability

We have seen that there are a number of similarities between singular and plural forms and also between C-ob and C-opt verbs. Now, we will examine how these pairs of forms differ. As with most natural languages, there are suppletive forms, or words in which it is not possible to show a relationship between morphemes by means of a

general rule. The forms involved have different roots (Crystal, 1985). Shilluk has such words. Two are shown below.

	Singular	Plural	Gloss
(117)	gìn	jám:ɪ̄	thing/s
(118)	gól	kál:ɪ̄	household/s

These words are obviously suppletive, i.e., derived from different roots. When positing different underlying representations for words in Shilluk, I am not suggesting that all forms are suppletive. The words do seem to come from the same root. However, what I am saying is that there is no way to write a general rule to derive the forms in the way that is commonly expected. In the following sections, I will look at the distinctions that must be listed in the lexicon while maintaining the claim that the words are intrinsically related, i.e., historically cognate.

3.2.2.1 Initial Root Consonant

With regard to the C_1, we have said that the C_1 may be a single consonant or a sequence of Consonant + Glide. In most words, the choice is one or the other for both forms. However, with some words, there is a change which is not predictable. One form will have a C + glide; the other form will have only a C. There seems to be no general way to account for the missing glide. Consider the following.

	Singular	Plural	Gloss
(119)	cwō̱r	cɔ̀:r	blind person/people
(120)	cwɔ̱t	cɔ̀:t	cow without horns
(121)	pyɛ̱n	pén:ɪ̄	sleeping skin/s
(122)	pyèr	pɛ̱̂r:ì	lower back/s

	C-ob	C-opt	Gloss
(123)	koɲ	kwuɲi	help
(124)	gwɔk	go:k	work

In previous examples in this chapter, we have seen that in general, the onset is the same in either form of a word. In these words, however, there is an exception to the 'rule'. Within the set of nouns which displays an onset alternation, the singular form has the C + glide while the plural words have a simple onset. In the verbs, there is no particular lexical pattern.

There are two ways to account for this alternation. First, it is possible to set up two underlying representations for these forms. The appropriate form is learned for each and no attempt is made to derive one from the other. The second possibility is to set up a zero alternation rule which could account for the data.

Probably the most common way to handle a zero alternation is to simply delink the segment when it should not surface. However, in order to write a rule for such a delinking, one would need a conditioning environment. The Shilluk data do not suggest such an environment, and so it would be necessary to indicate lexically which words, and which form of those lexical items would undergo this delinking rule. Thus, the

conditioning variable for consonant delinking could not be phonological in the case of Shilluk.

Another possibility is to handle the zero alternation in Shilluk as a morphologically based rule. In this case, it would mean that form 1 of a word would have the segment delinked while form 2 kept the segment attached to the timing tier. The data in (119) to (122) suggest that the Plural form delinks the glide while the singular does not delink it. Even in these examples, however, it would be necessary to indicate these words in the lexicon because not all Singular/Plural pairs with glides would undergo this rule.

Additionally, the 'Transitive' verbs would present a serious problem because the glide delinking could apply in either form depending on the lexical item. See examples (123) and (124).

We will see from other data that independent UR's are necessary for singulars and plurals as well as for verb forms. Since this is the case, incorporating this information into the UR is not actually complicating the analysis any further.

3.2.2.2 Final Root Consonant

While most words have an invariant C_2 in the root between forms, there are some exceptions to this principle. The most common type of variation is an alternation between [l] and [t] and between [r] and [t]. Below are examples of non-alternating C_2 forms followed by the alternating ones. This alternation was referred to in Chapter Two (2.2) when discussing the distinctive features necessary for Shilluk.

Non-alternating words

	Word (1)	Word (2)	Gloss
(125)	gɔ̄:l	gɔ:l	Wild Dog/s
(126)	acwi̱l	acwi̱:l	brown cow/s
(127)	bā̱t	bā̱:t	arm/s
(128)	gwar	gwa̱:r	to snatch (C-ob/C-opt)
(129)	ɗur	ɗur	to push

Alternating Words

	Word (1)	Word (2)	Gloss
(130)	lwɔ̄l	lɔ̱t	gourd/s
(131)	pāl	pā̱t	spoon/s
(132)	kâ:l	kā̱:t	cattle camp/s
(133)	ma:r	ma̱:t	to love (C-ob/C-opt)
(134)	gwi:r	gwi̱:t	to prepare
(135)	cwɔl	cwɔ̱t:i̱	to call
(136)	tyel	tye̱t:i̱	to pull

In the first set of words labeled 'Non-alternating', we see that C_2 is the same in both words. However, in the second set, there is an alternation in C_2 from [l] or [r] to [t]. The words in the second set are accounted for by a rule discussed in Chapter Five. It will be shown that these alternating final-consonants must be indicated in the Underlying Representation. The segment will be marked as an archisegment (i.e., an underspecified segment). As a matter of convenience, these archisegments will be transcribed with an upper case letter such as /L/ or /R/.

There are a few other words which show an alternation in the C_2. However, the pattern is somewhat erratic. It is assumed that the C_2 of these words would have to be included in the Underlying Representation and could not be predicted by rule. Some of these words are listed below.

	Singular	Plural	Gloss
(137)	dyèl	dyə̀k	goat/s
(138)	lè:jɔ̀	lə̄k	tooth/teeth
(139)	dway	dwat	moon/months
(140)	wīc	wə̂θ	head/s
(141)	yo:	yɐ:θ	road/s
(142)	mey	mɐ:k	mother/s
(143)	wiy	we:k	father/s

3.2.2.3 Root Vowel

Now we turn from consonants to the root vowel. First, we will look at the feature [Expanded]. Then, we will examine the changes in the vowel itself.

3.2.2.3.1 [Expanded] Vowels

If we wished to derived plurals from singulars or vice versa, we would need to be able to predict the [± Ex] value of the root vowels. The reader will recall that there are two sets of five vowels. They are repeated here for convenience.

[− Ex]		[+ Ex]	
i	o	i̱	u
e	ɔ	ɐ̱	ɔ̱
a		ə̱	

In order to derive singular/plural nouns or C-ob/C-opt verb forms, we must either have the same [Ex] feature on the vowel or be able to give a rule for any change of that feature. Let us look at the data.

	Singular	Plural	Gloss	[Ex]
(144)	ókwɔ̄r	ókɔ̂r:ì	serval	(−) (−)
(145)	ákɔ̀ɲ	ákɔ̃ɲ:ì	gazelle	
(146)	kél	kè:l	cheetah	
(147)	mɔ̀k	mɔ̄:k	type of fish	
(148)	ɲâŋ	ɲə̱ŋ:ī	crocodile	(−) (+)
(149)	káŋ	kə̂ŋ:ì	trumpet	
(150)	gwɔ̄k	gwɔ̃:k	work	
(151)	bák	bə̂:k	garden	
(152)	ŋù:	ŋúr:ī	lion	(+) (+)
(153)	pə̀m	pə́m:ī	table	

(154)	yɛ̰p	yɛ̰:p	tail	
(155)	gwɔ̰k	gwɔ̰:k	dog	
(156)	pyɛ̰n	pén:ɪ	sleeping skin	(+) (−)
(157)	θwɔ̰l	θól:ɪ	snake	

From these examples, we see that in the first set of four words, both singular and plural are [−Ex] values. In the second set, however, the singular is [−Ex] while the plural is [+Ex]. In the third set, we see that again both sets are the same. This time, both are [+Ex]. In the final set of two, the singular is [+Ex] while the plural is [−Ex]. This last set is the rarest, but it does occur. In short, [*a*Ex] → [*a*Ex] and [*a*Ex] → [−*a*Ex]. The feature [Ex] is not predictable, and both values must be represented in the lexical entries.

We have described the situation for nouns, but what about verbs? Can we predict the [Ex] value in C-ob and C-opt verb forms? Consider the data.

	C-ob	C-opt	Gloss	[Ex]
(158)	ban	ba:n	roll	(−) (−)
(159)	gɔc	gɔc:i	hit	
(160)	liθ	liθ:i	see	
(161)	yep	yɛ̰:p	open	(−) (+)
(162)	kor	kur	watch	
(163)	gam	gam̰:ḭ	catch	
(164)	gɔɲ	gɔ̰:ɲ	untie	
(165)	gac	ga̰:c	mark	(+) (+)
(166)	bɔy	bɔ̰y:ḭ	try	
(167)	rap	ra̰:p	burn	
(168)	cwɔ̰p	cop:i	stab once	(+) (−)

Again, we see that all four possibilities are available. The (+ −) combination is very rare, and seems to also correlate with alternations in the C_1 position. There is also a 'vowel height' change.

Out of 66 nouns chosen at random, 25 were (− −) [Ex], 27 were (+ +), 12 were (− +) and 2 were (+ −). Of 55 verbs, 7 were (− −), 19 were (+ +), 28 were (− +) and 1 was (+ −). According to these figures, 79% of nouns are predictable but only 47% of verbs. These figures suggest an appreciable margin for error for the language learner were he or she to assume predictability. It would seem the wisest course of action to assign the [Ex] feature as a vowel feature in the Underlying Representation for both forms of nouns and verbs.

3.2.2.3.2 Root Vowel Change

There are occasions when not only is the [Ex] feature not predictable, but even the 'vowel height' changes. Consider these words.

	Singular	Plural	Gloss
(169)	beθ	biθ:i	fish spear/s
(170)	bò:dɔ̀	bɔ̰:θḭ	craftsman/men
(171)	cɔ̰:gɔ́	cūw	bone/s
(172)	óbwɔ̂rɔ̀	óbwūr	type of grass
(173)	òkɔ̀dɔ̀	ókûθ:ḭ	hedgehog/s
(174)	rɛ̰:jɔ́	ríc	fish
(175)	θwɔ̄l	θól:ī	snake/s
(176)	áθḭwī	àθèw	small container/s
(177)	kwéy	kwa̰:y	grandfather/s
(178)	cúŋ	cɔ̄ŋ	knee/s

	C-ob	C-opt	Gloss
(179)	kɔɲ	kwuɲ:ḭ	help
(180)	jɔli	jut:ḭ	repeat
(181)	cwɔ̰p	cop:i	stab once
(182)	bel	bit:i	taste
(183)	rep	rɲp	add
(184)	dɔm	dum	save

In these words we see alternations between the following vowels:

e ~ i	e ~ a̰	ɔ ~ u
e ~ ḭ	o ~ ɔ̰	ɔ ~ o
ɛ̰ ~ i	u ~ ɔ	ɔ̰ ~ u
ḭ ~ e		ɔ̰ ~ o

or factoring out [Ex],

E ~ I
O ~ Ɔ
E ~ A

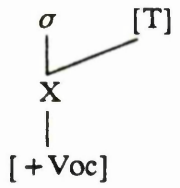
There does not seem to be any pattern of correlation between the [Ex] value and this alternation in 'vowel height' since both [Ex] values seem to be equally involved. The vowels are not exclusively high or low, front or back. The majority of alternations involve front vowels with front vowels (I ~ E) and back vowels with back vowels (O~Ɔ) or unrounded vowels with unrounded vowels (E~A). Since there is no predictable pattern or even a restriction on variability that could easily be placed on these words, we must again opt for representing both forms in the Underlying Representation.

It would appear that, in a McCarthian model, Shilluk vowels could be said to have morphemic status since they are highly independent and lexically significant. Elements encoded into the vowel morpheme are the [Ex] and 'vowel height' features.

3.2.2.4 Tone

The next point that we will consider here is the tone. Tone is a feature assigned to the root; thus, it is considered separately from the root vowel. The tone is eventually realized on the vowel which is the Tone Bearing Unit (TBU). In order to assure that tone is associated in the correct X slot, the following representation spells out the relationship amongst the syllable head, X slot, vowel and tone.

(185) Tone Association



This representation states that tone can only be linked to an X slot which is also associated with *both* a syllable head and a segment with [+Voc] content. If either of these elements of [+Voc] or syllable headedness is absent, then the tone cannot be linked to that X slot.

Since there is a grammatically significant role of tone in the verbs, we will only consider tone on the nouns. It would be helpful to the language learner if tone were predictable between singular and plural forms. However, it seems that Shilluks are able to cope with a considerable amount of unpredictable behavior with regard to the tone. It is a rare experience to find a singular/plural pair which has the same tone.

We will begin our discussion with words with at least one H tone in the singular.

	Tone	Singular	Plural	Gloss
(186)	H-H	kwér	kwé:r	small lizard/s
(187)	H͡L-H͡L	gwɔ̰k	gwɔ̰:k	dog/s
(188)	HL-H͡L	gɛ̰:lɔ̰	gɛ̰:l	riverbank/s
(189)	H͡M-H͡M	ápɔ̰:dɪ̄	ápɔ́t:ɪ̄	calabash/es
(190)	H-L	kél	kè:l	cheetah/s
(191)	H-M͡L	bák	bâ:k	garden/s
(192)	H-LL͡H	dítáŋ	dìtă:ŋ	black bull/s
(193)	HL-M͡L	cúrɔ̰	cùr	Eel-like Catfish/es
(194)	H͡M-H͡L	bâ:ɲɔ̰	bâ:ɲ	grasshopper/s

In the first four examples, we see that H, H͡L and H͡M have identical tone patterns in singular and plural. However, in the next five examples, we see quite a different story. The H in the singular may correspond to L, M͡L, L͡H in the plural while H͡L has a plural counterpart of M͡L. Further, a singular H͡M may have a plural with H͡L. This is not a complete listing of the possibilities, but the sample here is representative of the problem. As such, we could end the argument here. But it is useful to see the extent of the problem.

We move on to the M tone. We find a similar situation to the H tone.

	Tone	Singular	Plural	Gloss
(195)	M-HM	kyɛ̄ŋ	kyɛ́ŋ:ɪ̰	horse/s
(196)	M-M̂L	jwɔ̄k	jwɔ̰̀:k	god/s
(197)	M̂L-H	ɗɔ̰̀ŋɔ̰̀	ɗɔ́ŋ	basket/s
(198a)	M̂H-M̂L	gɔ̄:l	gɔ̂:l	Wild Dog/s
(198b)		bā́t	bâ:t	arm/s
(199)	M̂L-ML	bâ:r	bār:ì	tall sg/pl

There are *no* cases when there is a level M in both singular and plural words. There are identical ML sets (199). More commonly, however, we see that M in the singular can be matched with HM, M̂L or H in the plural. Again, not all options are listed.

Now consider singulars with L tone. The tones may be the same as in (200) and (201) below. However, in most cases, the tones will be distinctly different. In the following examples, note that a singular L may correspond to M, H, L̂H, and M̂L in the plural. Likewise, LH may go with H, M, or ĤL.

	Tone	Singular	Plural	Gloss
(200)	L-L	gyɛ̰̀k	gyɛ̰̀:k	Nile Lechwe/s
(201)	L-L	gɔ̀k	gɔ̀:k	white skin bracelet/s
(202)	L-M	ɗɔ̀ŋɔ̄	ɗɔ̄ŋ	Juba person/people
(203)	L-H	cìŋɔ̄	cíŋ	hand/s
(204)	L-L̂H	kùl	kŭl	pig/s
(205)	L-M̂L	lɔ̀:θ	lɔ̄θ	club/s
(206)	LH-H	byɛ̰̀:lɻ́	byél	millet
(207)	LH-M	cɔ̰̀:gɻ́	cūw	bone/s
(208)	L̂H-ĤL	kĭy	kîy	plant/s with edible roots

If we consider only surface level tones for the moment, we find that we can have the following correspondences between singular and plural.

Plural Tone

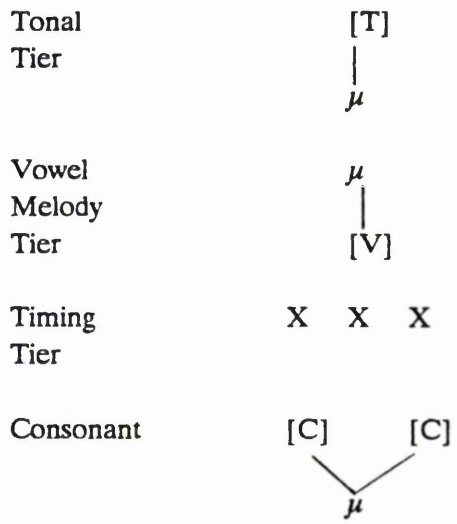
Singular Tones	H	M	L
H	X		X
M	Sequences only		
L	X	X	X

We see that H singular tones may be H or L in the plural. L singular tones may be H, M or L in the plural. That much seems highly irregular. But then, a M singular tone cannot have a M plural tone! That in itself would push us toward the position that the underlying tones must be represented independently in the lexicon. There seems to be no way to predict it. Given this high degree of independence and the fact that certain tones correlate with grammatical features, tone would seem to have morphemic status. Therefore, we must have the morpheme for tone, and the vocalic morpheme including the 'vowel height' and the [Ex] feature listed for *both* singular and plural forms.

3.3 Underlying Representation

Having looked at the data, it is now time to try to formulate the lexical entries for nouns and verbs. Shilluk is a language with extreme tendencies to multiple variation. In the previous sections, it has become clear that consonants, vowels and tone vary within lexical items. In some cases, the variation is also grammatical since certain tones and initial consonants may each distinguish number.

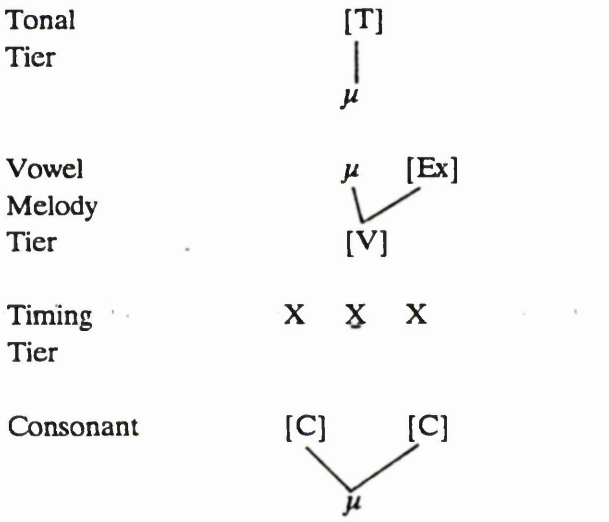
McCarthy (1982:192ff) argues that morphemes should be represented on separate tiers. Further, he suggests that even the canonical pattern or prosodic template of the lexical item can be considered a tier in its own right. Evidence presented in Chapter Four will show that this same argumentation is relevant to the Shilluk data. For the moment, however, it seems advantageous to represent tone, consonants and vowels on separate tiers. Each of these tiers represents a lexically variable and hence lexically significant morpheme.



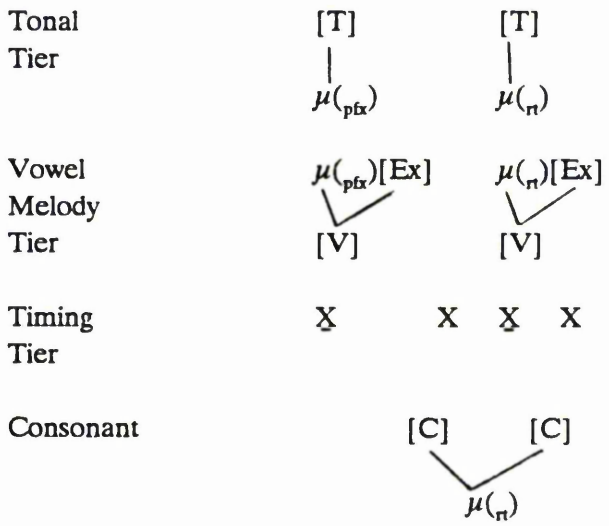
Within this representation, it will be necessary to include information regarding the X slot with the syllable head. It is assumed in this thesis that the syllable head is present in the underlying representation. The vowel features would associate to the syllable head.

One notational problem needs to be dealt with here. The general notation used to indicate a syllable head is a perpendicular line over the appropriate X slot. However, given the two-dimensional restrictions of the paper on which it is drawn, the $(\overset{|}{x})$ configuration could easily be assumed to be an association line. Therefore, I propose an *ad hoc* representation of syllable headness such that an underscore of the $\underline{X}$ slot indicates that there is a syllable head associated with it.

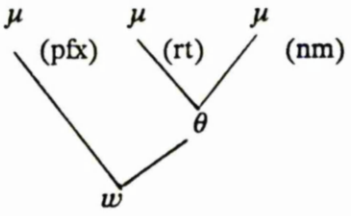
The [Ex] feature is a subvariant feature which attaches to the vowel and does not appear to have morphemic status. Therefore, the [Ex] feature will be shown in the representation as being associated to the vocalic tier. Below is the representation including the [Ex] feature and the new notation for the syllable head.



Finally, we have seen evidence that affixes are also morphemes in Shilluk. Again, these morphemes may be on separate tiers. However, these additional tiers will seriously complicate the task of representing it on paper. Therefore, when affixes are added, they will be marked with a (μ) and tagged.



The 'root' itself, as it refers to the CVC pattern, is made up of several morphemes; namely, the vowel, consonants, and tone. This 'set of morphemes' can be taken together to make up a 'root'. This 'root' can then be combined with other sets of morphemes to form other structures. For example, the 'root' and the Number (nm) suffix combine to form a stem. This stem will be represented by a *theta* (θ). The addition of a Prefix requires yet another level; namely, the word (w). Already the representation is becoming difficult to manage; so I will show this aspect of it separately.



We will see in Chapter Five that there is a special phonological significance to the 'stem' and therefore, it must be indicated.

One further complication in the representation is that most of the words in Shilluk will require dual representation for singular and plural and for C-ob and C-opt. The representations will be side by side. For consistency's sake, the singular will be on the left and the plural to the right for nouns. The C-ob will be on the left and C-opt form on the right for verbs.

It will be assumed that there are no 'bundles' of features. Each feature may have its own plane or tier. However, it will be necessary to consider several features together, for example, in the identification of a particular phoneme. Where it is relevant, the features will be listed. However, for the convenience of the reader, letter symbols will also be used as an abbreviation for the feature complexes.

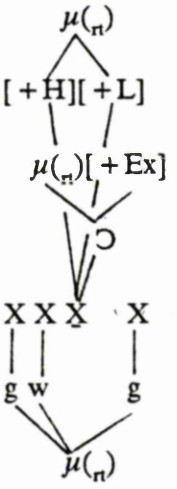
We will now work through the various parts of the representation step by step. We begin with the consonant melody tier.

In most cases, the C_1 and C_2 are identical in both forms of singular and plural. The representation reflects that similarity for [gwo̱k] [gwo̱:k] 'dog/s'(155).

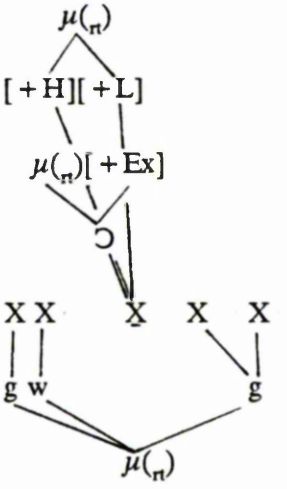
As discussed earlier, however, sometimes the onsets are not the same. In these cases, the representations will be distinctly different, as in the case of [pye̱n] [pen:i] 'sleeping skin/s' (156).

Next, we need to fill in the root vowel. First, we will indicate the symbol representing the underlying 'vowel height' (using upper case letters). The feature [Ex] will be attached to the segment. Tone is on a separate tier, but will be indicated above the Timing Tier and above the vowel tier since it will eventually be realized on the vowel. We continue with the same words as above.

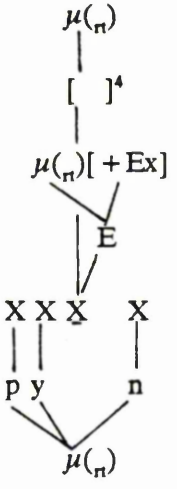
(155a)



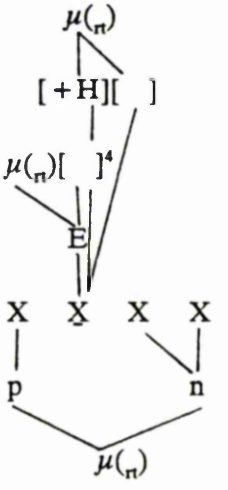
(155b)



(156a)

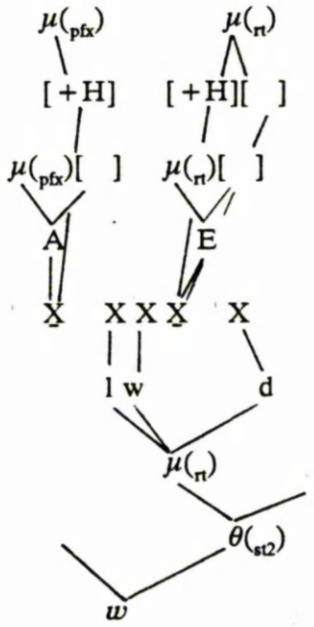


(156b)

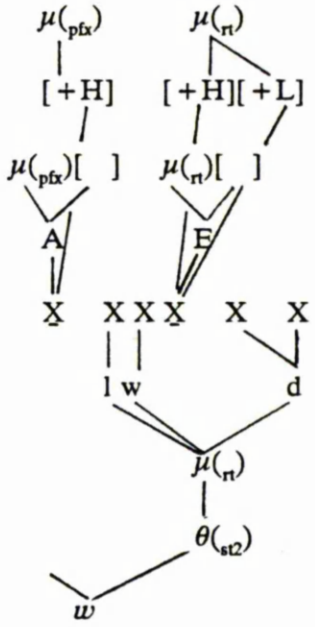


Since nominal prefixes are no longer part of a productive word formation process, we will need to incorporate the prefix into our word in the lexicon. We will keep the prefix distinct from the 'stem' by means of (Pfx) tag on the morphemes associated with it. For the moment, the tone and [Ex] feature will be assigned to the prefix. There is a discussion of this process in Chapter Five. The UR for [álwɛ̂:dɔ̀] [álwêt] 'crab/s' (97) is shown below.

(97a)



(97b)



In Section 3.1, it was explained that there are three sets of nouns. Words need to be marked in the lexicon so that the appropriate suffixes can be added. Therefore, each noun root must have a marking for noun set 1, 2, or 3.

In this example, Noun Set 2 is indicated. Set 2 has singulative and neutral forms. Therefore, the singulative would receive the -ɔ suffix by rule. A Set 1 word would receive the -i suffix on the plural. Set 3 words would receive both singulative and plural suffixes. It may be necessary to add a fourth set for words which have no number suffix in either singular or plural form.

In all cases, the plural would have a geminate C_2 in the root. It may not be retained throughout the derivation, but it will always be in the underlying representation as a marker for plurality.

There is only one remaining point which has not been touched on. This point involves the length of the root vowel. It will be noticed in the previous example that the root vowels are of different lengths. This difference can be explained by means of syllable structure. Syllable structure is a complex issue in itself and is covered in Chapter Four. We will find that syllable structure must also be marked in the lexicon. In most cases, the same syllable structure will apply to both forms. But, as seems to be the rule for Shilluk, there will also be a few exceptions to that.

FOOTNOTES

[1] These words [reŋ:] and [reŋ] are the same underlyingly. A syllable structure rule shortens the geminate consonant word-finally.

[2] Subsequent study has revealed that the distinction between forms is based on the presence or absence of the *Object* rather than the Complement. The C-opt form cannot have a Complement which is an *Object*, but can have a Benefactive or Instrumental Complement. However, we cannot term the forms 'with Object' or 'Objectless' because of the VCmCm order. The Verb form in the VCmCm order is the C-opt form and there *is* an *Object* in the second slot.

The only connection I have found so far between these two uses of the C-opt form is that in both cases, the Object can be said to have no close contact with the verb. Either the Object is not present (SVCm Active order) or it is separated from the verb by an adposition (VCmCm).

Given this recent re-analysis, it would have been preferable to use some other, more neutral terms than C-ob and C-opt. However, since part of the thesis had already been printed, there was insufficient time to correct the terminology. Thus, the reader is advised not to attach too much weight to these names, and should simply regard them as labels to distinguish between two forms of the Transitive verbs.

[3] Some words have not been marked for tone because it has not been possible to check the tone on these particular words with native speakers.

[4] The underspecified tone will be filled in by Complement Rules and will be realized as [−Hi, −Lo]. Likewise, the underspecified [Ex] value will be filled in as [−Ex].

CHAPTER FOUR

SHILLUK SYLLABLE STRUCTURE

4.0 Introduction

In the preceding chapter, we saw that there are some variations in the length of the root vowel. In order to account for these and other changes in derived forms, we must examine the role of syllable structure in Shilluk. We will see that the syllable structure has a pervasive influence throughout the phonology. Indeed, syllable structure is probably the most important aspect of Shilluk phonology. Let us begin examining this key to Shilluk by looking at the surface possibilities.

4.1 Surface Overview

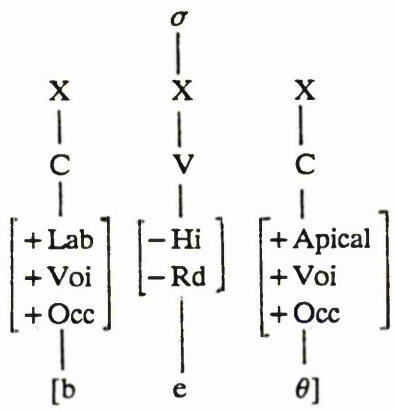
At first glance, the syllable shapes in Shilluk do not appear to be problematic. The most common syllable pattern is CVC. Below are listed words which represent the surface representations of the various patterns.

(1)	V	u	'and'
(2)	C V	yi	'you (sg)'
(3)	V C	ɔt	'house'
(4)	C V C	beθ	'fish spear'
(5)	C V V C	bu:r	'grave, hole'
(6)	C C V V C	kwe:r	'small hoe'

Such a listing of surface patterns does not provide us with a formal apparatus for adequately discussing the subject of syllable structure. Instead, recognition of a separate tier dealing with syllable structure seems to be the most enlightening way to approach the matter.

4.2 Syllable Structure Tier

As with other tiers, the syllable structure tier is associated with the timing tier. It is a basic assumption that underlyingly, words are only partially syllabified. It will be assumed that X slots in the UR are preassociated with the syllable heads. In order to simplify the representations, C and V tiers will be shown together. Also, since syllable structure is being emphasized in this chapter, other tiers will be conflated to conserve space and to improve clarity. Thus, we might begin with an Underlying Representation like the one shown below:



Syllable Structure Tier

Timing Tier

CV Tier (Conflated)

Segmental Tiers
(also Conflated)

'fish spear'

Notice that the syllable head is attached to a row of X's. These X's represent timing slots. The timing slots are then associated with a CV Tier. We see that having the syllable structure in place effectively eliminates the need to have the CV Tier as the syllable structure will define the vowels. When the syllable structure is fully in place, the consonants and vowels will be defined by that structure. Thus, in future, the C and V Tiers will not be given. Next, we see that feature complexes are associated with the timing tier. In the interest of conserving space, the phonological symbols (*as per* 3.3) will be used on this level to represent these feature complexes whenever the features in question are not particularly relevant to the discussion.

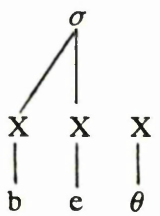
The syllable (σ) is made up of the Onset (O) and the Rime (R). The Onset is anything to the left of the syllable head. The Rime is composed of the syllable head, sometimes termed the Nucleus, plus anything to the right of the syllable head. Following Noske (1982), I will assume that the onset-rime distinction is a universal of syllable structure. The process for syllabification, then, will have two parts.

a. "Co-syllabify all X's to the left of the syllable head subject to the language-specific constraints governing onsets."

b. "Co-syllabify all X's to the right of the syllable head subject to the language-specific constraints governing rhyme structure " (Hayward, 1986:312).

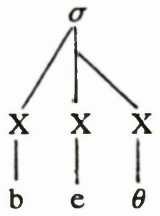
Continuing with the example above, the first step is to co-syllabify the onset.

(7b)

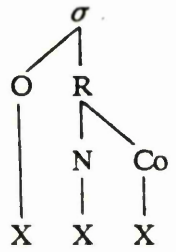


The last step, then is to co-syllabify the rime.

(7c)

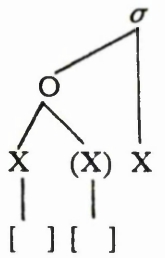


For the purposes of this thesis, a syllable will consist of an Onset (O) and Rime (R). The Rime is composed of a Nucleus (N) and a Coda (Co). Syllable heads will usually be shown with a vertical line (|). (The only exceptions to the notation convention described here are to be found in Chapter Three and in Chapter Five.) Any line shown at an angle is intended to indicate either Onset (/) or Coda (\) in its relation to the nucleus.

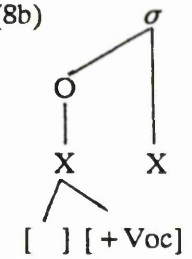


It was decided in Chapter Two that the onset consonant plus glide was a sequence rather than a single unit. In the schematic representation, I will use two X slots in the onset which may be filled by a sequence of a consonant and a glide ([w] or [y]). The representation is shown in (8a). Had I chosen to interpret the C + glide as a unit, only one X slot would have been needed. The representation for that unit is shown in (8b).

(8a)



(8b)

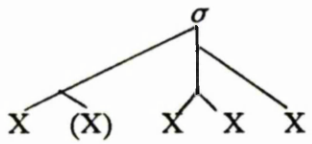


We may assume that it is always possible to have a sequence of consonants in the onset. In order to simplify the representation, examples without the sequence will be shown with only one X since the X slot for the glide is optional. Where it is relevant, both X slots will be included in rules.

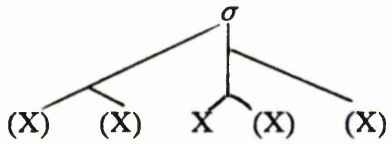
4.3 Syllable Template

It has been assumed that the syllable is only partly specified in the underlying representation. Particularly, only the syllable head is supplied. From this point, we need some further guidelines for implementing the syllabification process with regard to language-specific constraints. One way to do this is to specify a maximal syllable template for the language such as the template in (9).

(9)



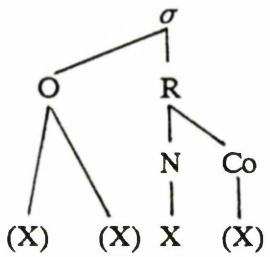
The structure in (9) would account for the maximally possible syllable in Shilluk (e.g., *kwe:r* 'small hoe'). We might generalize this template to account for all other possible syllable patterns by indicating certain X slots as optional. We would then have an overall Shilluk syllable template like the one shown below.



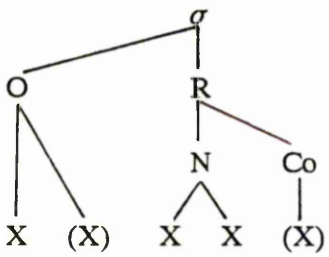
Having developed this general structural template, we find that it is not terribly revealing. The only definitive bits of information which we can gather are that (1) codas do not branch, and (2) every syllable has a nucleus, and that is not unexpected. Therefore, let us examine the problem from a less generalized perspective.

In fact, Shilluk requires two distinct syllable templates, a crucial element of the more marked of which must be indicated in the UR. The two templates are shown below.

(10a)



(10b)



The first template (10a) will acount for CV, V, VC, CVC and CVV patterns. The second template (10b) accounts for CVV and CVVC. There is an overlap with respect to CVV, but it will become clear later why there are two CVV patterns.

I have said that one of these templates is more marked than the other. But how can such templates be evaluated in terms of markedness? Kaye and Lowenstamm (1981) and Noske (1982:271) have discussed theories of syllable markedness. The hierarchy, as given by Noske, is as follows.

(11)

Onset	Rime	Markedness Value
C	V	0
Ø	V C	1
C C	V C C	2
C C C	V C C C	3
$C_1...C_n$	$VC_1...C_n$	n

The thrust of the arguments of all these investigators is that requiring the syllabification algorithm to define syllables having the lowest possible markedness value provides a constraint for making testable empirical predictions for the phonologies of natural languages. Kaye and Lowenstamm as well as Noske say that VC and VV would be equally complex. Likewise, VCC and VVC would be equal as well.

This theory, then, would account for the fact that the second template CVVC is more rare since it contains more timing slots and thus more weight in the rime. We could eliminate the second template except for the overlap of VV in both. The syllabification of VV in (10a) is more common than that of VV in (10b). Further discussion on this point may be found in Section 4.5.4.

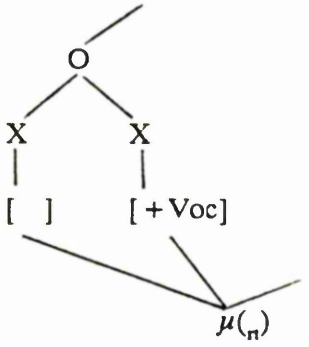
4.4 Restrictions and Constraints

We will find that many of the phonological rules in Shilluk are controlled by the syllable structure. It is vital to the discussion in the remainder of this chapter to establish the restrictions and constraints which apply to Shilluk. The restrictions and constraints for the onset will be reviewed. Then the constraints for the syllable head and coda will be discussed.

4.4.1 Onset Constraints

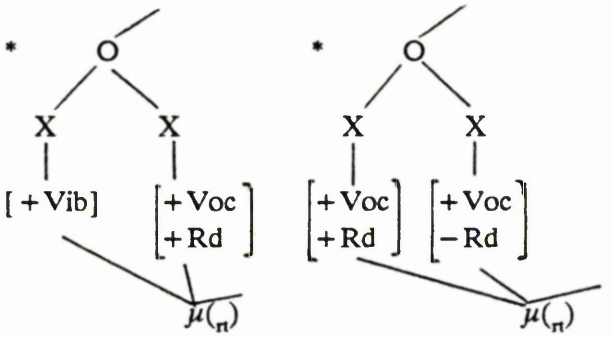
The constraints placed on the onset position were covered in Chapter Two. They are repeated here for the reader's convenience. The first constraint is concerned with the sequences of consonants which are allowed in the onset slot.

(2.78) Initial Consonant Sequence



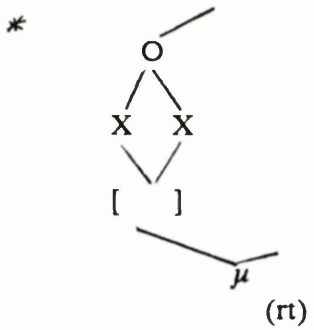
Two constraints are placed on the initial root sequences.

(2.79) Initial Consonant Sequence Constraint



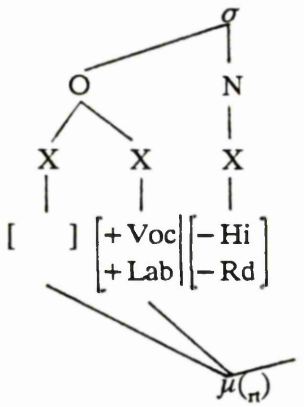
The first statement (2.78) allows for any consonant to be followed by a glide [+Voc]. The more specific constraints would then apply such that *[rw] and *[wy] would not be allowed. Further, a geminate consonant cannot occur initially in a root.

(2.90) Initial Geminate Consonant Constraint



Finally, we have a constraint which involves the Onset and the Nucleus. Since it involves the Onset, it will be included in this section. It is stated as follows.

(2.80) Glide and Vowel Constraint



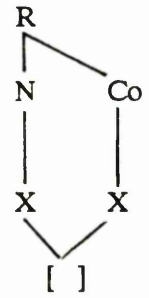
In this constraint, the [y] glide may only be followed by [−Hi, −Rd] vowels.

4.4.2 Syllable Head Constraint

If two timing units are associated with one syllable head, they must have the same feature matrix. This fact remains in force regardless of whether Template (10a) or (10b) is under consideration.

(12) Syllable Head Constraint (SHC)

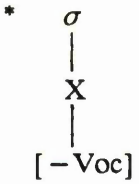
(10a)



(10b)

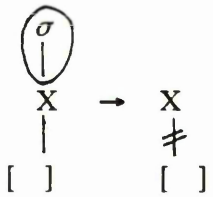
It will be assumed that the vowels associate to X slots with a syllable head. The constraint shown below says that if an X slot has a syllable head, it cannot have [−Voc] content.

(13a) Vocalic Association Constraint (VAC)



If at some point in the derivation an X slot loses its syllable head association, then it also loses its [+Voc] content. The Vocalic Delinking Rule states that if a syllable head is pruned, the [+Voc] content is delinked. 'Pruning' here is indicated by encircling the syllable head and it s accompanying association line.

(13b) Vocalic Delinking (VD)



4.4.3 Coda Constraint

Shilluk syllables are typically 'heavy' syllables. A heavy syllable, as defined by Hyman (1985a) may be VC or VV or in other terminology, a heavy syllable is a syllable whose rime branches. As we have seen, in most Shilluk words, the rime does branch into a

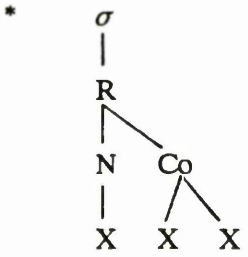
nucleus and a coda. As such, the 'norm' for Shilluk words is to have a 'heavy syllable' (CVC).

In the case of a word with the structure CVVC, it is considered to be a 'superheavy' syllable. The rime structure is VVC. It is not possible to have VCC in the rime of a Shilluk syllable.

From the perspective of the syllable templates, the claims being made for Shilluk are 1) that the nucleus can branch, but only in marked (lexically specified) cases, and 2) codas cannot branch. Evidence for these claims will be discussed shortly.

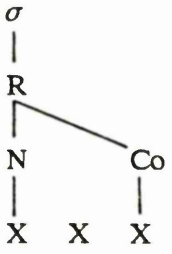
The Branching Coda Constraint says that it is not permissible for a coda to branch.

(14) Branching Coda Constraint (BCC)



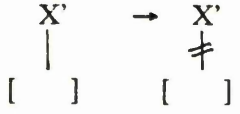
In the event that a branching coda could arise in the course of a derivation, there needs to be a principle to govern the syllabification process. Shilluk seems to have chosen a principle of rightmost selection in the case of codas. In other words, given two or more unsyllabified X slots, the rightmost slot will be the one to be syllabified.

(15) Coda Syllabification (Rightmost Selection) Principle (CSP)



Finally, if an X slot is left unsyllabified, then the feature matrix of the segment will ultimately receive no phonetic realization. This unsyllabified segment delinking convention is shown in (16).

(16) Segment Delinking Convention



Following Haraguchi (1987), Michaels (1987) and Noske (1987), syllabification

constraints will control the inclusion or exclusion of timing elements within Shilluk words. In order to show how syllable structure functions, it will be necessary to show forms in the underlying representation which are not considered 'allowed' or 'proper' forms. The Coda Syllabification Principle (CSP) will be employed to correct the form into an 'allowable' or syllabified structure. In this way, we will see how important syllabification is in Shilluk. Instead of devising *ad hoc* rules to account for various vowel and consonant insertions or deletions, syllabification rules will provide a simple, consistent means for explaining numerous 'irregularities' in Shilluk.

4.5 Application of Syllable Structure

In this section, we will apply the syllabification procedures and constraints to underlying forms. Most of the examples are nouns since they are often inflected. Verbs have the same type of syllable structure, but are not inflected. Verbs will be included to show the C-ob and C-opt forms, but without any inflections.

There are three varieties of words distinguished by the length of the root vowel. Initially, we will look at the Invariably Short (IS) Vowel words. Within the root of these words is a single vowel which shows no long vowel in any other forms. These words contrast with Invariably Long (IL) and Alternatingly Short and Long (ASL) Vowel words discussed in Sections (4.5.3) and (4.5.2), respectively.

It will be recalled from Chapter Three that there are two types of semantically singular nouns. The neutral form was referred to as Singular (Sg) while the morphologically marked form was referred to as a Singulative (Sglt). The semantically plural words also have morphologically marked and unmarked forms (Plural (Pl) and Collective (Coll), respectively).

As words are introduced for derivation, the morphemic structure (μ) will be shown. However, in subsequent steps and subsequent uses of the same example word, that particular aspect of structure will be omitted. In general, only the relevant morphemic structure will be indicated.

4.5.1 Invariably Short Vowel Words

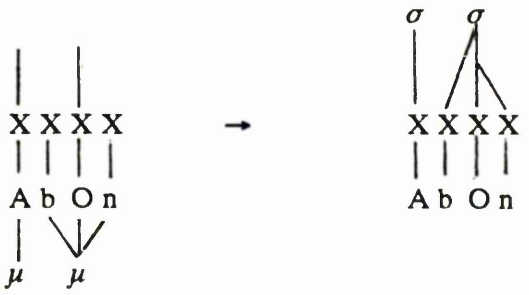
Below we see examples of Invariably Short Vowel words from both the Singular and Singulative sets. Given alongside the citation form is the word with the possessive marker *-ē* 'his/hers/its' and also with the referential determiner *-ání* 'this'. In addition, some examples of C-ob and C-opt verb forms are included.

	Sg	Sg + Ps	Sg + ání	Gloss
(17)	cyɛ̱́w	_____	cyɛ̱wání	porcupine
(18)	àbôn	àbónē	àbónání	pastor
(19)	díθwɔ̱l	díθwɔ̱lē	díθwɔ̱lání	black & white bull
	Sglt	**Sglt + Ps**	**Sglt + ání**	**Gloss**
(20)	àkèlɔ̀	àkèl:ē	àkèl:ání	kind of food
(21)	ɖɔ̱ŋɔ̱	ɖɔ̱ŋ:ē	ɖɔ̱ŋ:ání	basket
(22)	àbûrɔ̱	àbûr:ē	àbûr:ání	reedbuck

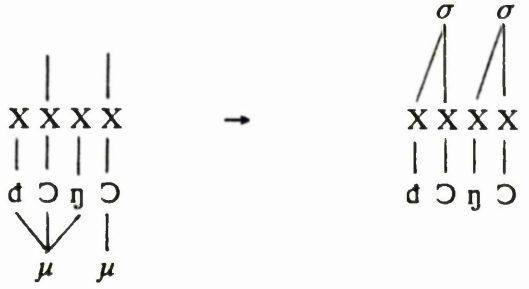
	C-ob	C-opt	Gloss
(23)	kum	kumɔ̲	to cover
(24)	keθ	keɗɔ	to go
(25)	dic	dijɔ	to lock

Underlyingly, we assume the syllable heads to be indicated. The relevant morphemes are also shown. In order to syllabify the various words shown here, we first associate the the X slot to the left for the onset. If there is a consonant + glide sequence, then two X slots would be associated to the Onset. Then, the X slot to the right is associated for the coda or internal rime structure so that the resulting structure conforms to the syllable templates allowed in Shilluk. We see from the following examples that in both cases the process is very straightforward.

(18a)



(21a)



4.5.2 Alternatingly Short and Long Vowel Words

Now we come to the largest set of words; namely, Alternatingly Short and Long Vowel Words. Below are a few examples.

	Sg	Sg + Ps	Sg + ání	Gloss
(26)	pà̲m	pà̲:mē	pà̲:mání	sawn timber
(27)	káŋ	ká:ŋē	ká:ŋání	trumpet
(28)	θwɔ̲l	θwɔ̲:lē	θwɔ̲:lání	snake

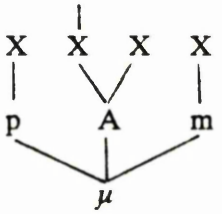
	Sglt	Sglt + Ps	Sglt + ání	Gloss
(29)	byè̲:lɔ́	byè̲l:ē	byè̲l:ání	millet
(30)	c̠i̲:nɔ̲	c̠i̲n:ē	c̠i̲n:ání	intestine
(31)	dwà̲:lɔ̀	dwà̲l:ē	dwà̲l:ání	fat

Verbs

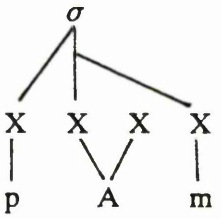
	C-ob	C-opt	Gloss
(32)	bak	ba̱:gɔ̱	to boil
(33)	bak	ba:gɔ	to fence
(34)	ra̱p	ra̱:bɔ̱	to burn

We find that in Sg words, the root vowel is short in the citation form but long in the inflected forms. By contrast, in the Sglt forms, the root vowel is long in the citation form but becomes short in modified forms with the appearance of a geminate root-final consonant. We will examine each group individually beginning with an example from the Sg set. The leftmost segment of the head is pre-associated, but the other is not. Since codas cannot branch, the string is syllabified according to the Coda Syllabification Principle (CSP). The coda is associated to the unsyllabified X slot which is farthest from the syllable head. In this case, the penultimate X slot is left unassociated, and thus will not appear on the surface.

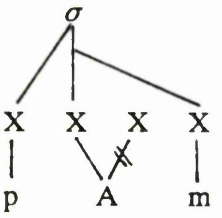
(26a)



According to our syllable structure hierarchy of section 4.3, template 10a for CVC or CVV words is the expected pattern rather than 10b for CVV or CVVC. The use of the 10b template will be dealt with in Section 4.5.3 and 4.5.4. For the present, we will chose the more common template and attempt to syllabify the string.



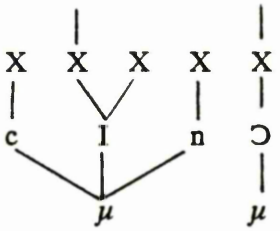
We see that one of the post-head X slots cannot be syllabified. As a result, the Coda Syllabification Principle is applied to syllabify the coda.



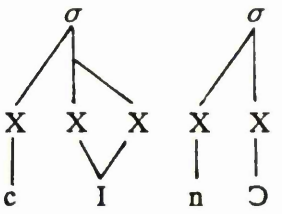
The segment attached to the unsyllabified X slot cannot surface by the Segment Delinking Convention. The result is the correct surface form [pa̱m].

The presence of a word-final vowel in the Sglt words allows the syllabification process to proceed without any problems. Take the following example:

(30a)



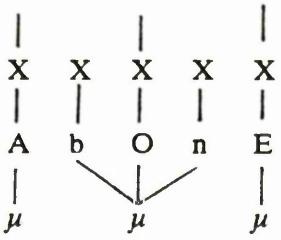
Syllabifies to



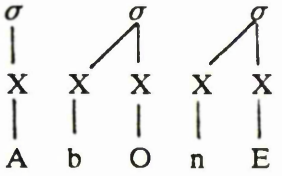
Here the coda slot syllabifies the second vowel slot since the [n], in this case, is the onset of the second syllable. The C_2 becomes the onset of the second syllable. The second slot of the vowel is syllabified as the coda. All segments surface.

While these examples are fresh in our minds, let us look at inflected forms such as the possessive marker (ps) and the referential determiner (rd). We will find in Chapter Five that the number marker (nm) has special significance to the phonology and must be handled separately from the other inflections. The inflected Sg words create no problems since they end in a vowel. Below are examples from both the IS vowel words and the ASL vowel words.

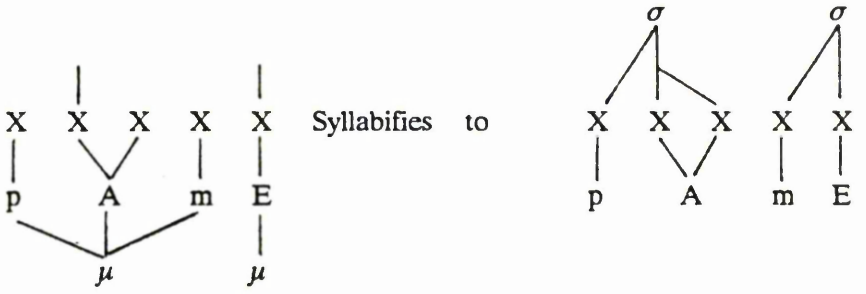
(18b)



Syllabifies to



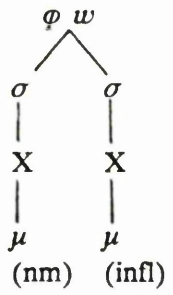
As we look at the ASL vowel words, we see that the inflected form has none of the complications of the citation form of the word. The root-final consonant has become the onset of the next syllable and the second root vowel fits into the coda slot. As a result, there is no unsyllabified element.

(26b) 

Noske (1982:274) suggests that syllabification is persistent. His hypothesis states that once syllabification has applied, re-syllabification takes place persistently. We will see, not only in the current example, but also in the succeeding ones that this hypothesis is upheld.

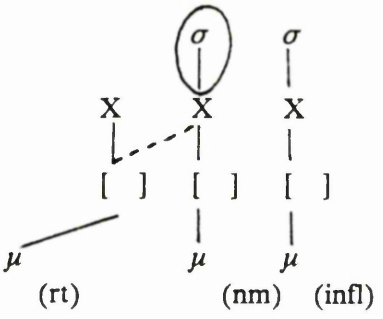
Perhaps the clearest application of the persistent syllabification process is seen with words ending in a vowel. In this situation, a word level constraint comes into play. In Shilluk, two distinct syllable heads may not occur together without an intervening consonant.

(35) Phonological Word Level Constraint (PWL)

* 

When, in the course of a derivation, this Phonological Word Level Constraint is violated, the Dual Syllable Head Pruning Rule is implemented to make the structure syllabifiable.

(36) Dual Syllable Head Pruning Rule (DSHP)

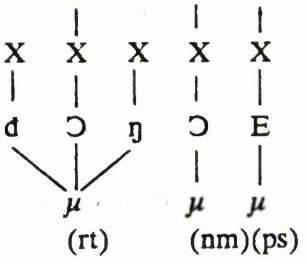


The DSHP prevents the disallowed structure of two contiguous syllable heads by pruning the leftmost syllable head. The [+Voc] features that have been associated to the X slot with the syllable head (13a) must be delinked because the structure for defining a vowel is no longer present (13b). It is important to note that the X slot is not lost. Instead, the

feature matrix from the preceeding X slot is allowed to spread onto that slot. Shilluk normally implements left to right spreading.

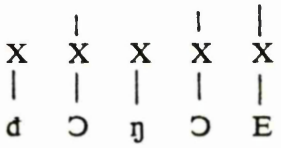
Let us look at a case in point, *ɗɔŋɔ+e* 'his basket.'

(21b)

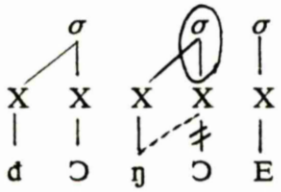


From the example shown here, it is apparent that the Phonological Word Level Constraint, (35), will be violated. When two syllable heads come together at the word level, the leftmost one is pruned. However, the timing slot is not lost even though the [+Voc] content is delinked. Instead, the root-final consonant spreads left to right (L → R) onto that slot resulting in a geminate consonant. The end result is a CVC+CV pattern.

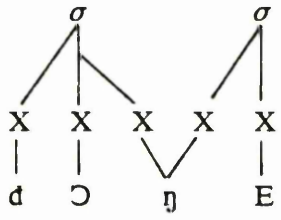
(21b)



Syllabification
will violate PWL
DSHP and VD

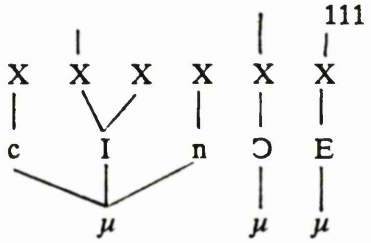


Re-syllabification
and Surface Form



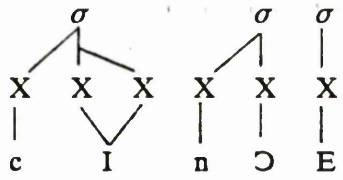
When considering the ASL vowel words, there is a slightly more complicated situation. We return to a previous example, this time with a possessive inflection, *ci̱.nɔ̱+e* 'his intestine.' First, we have the UR, partially syllabified.

(30b)



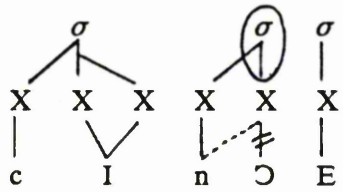
↓

Syllabification
will violate PWL



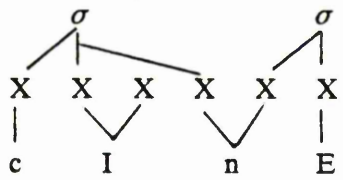
↓

DSHP and VD



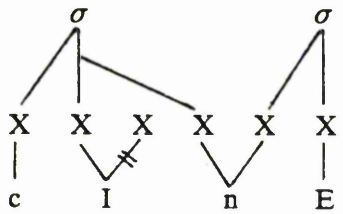
↓

Re-syllabification,CSP



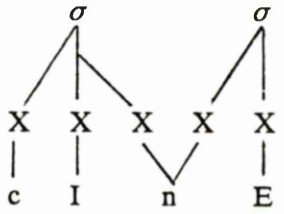
↓

SDC



↓

SF



The Dual Syllable Head Pruning Rule (DSHP) eliminates the Sglt (nm) suffix and allows for the doubling of the root-final consonant. The resulting form must be resyllabified. The CSP applies and leaves the second vowel unsyllabified. Since it cannot be syllabified, it cannot surface.

It may appear that a lot of fuss is being made over a simple vowel truncation rule that shortens a vowel in a closed syllable. However, there is more to this problem, for now we must account for words which remain long under all conditions.

4.5.3 Invariably Long Vowel Words

In the words given below, we see that the vowel in the root is long and remains so in the inflected forms. Notice also that there is no gemination of the root-final consonant since geminate vowels and consonants may not both occur in a single root. If a geminate consonant occurred, then the coda would branch and that structure is not allowed in Shilluk.

	Sg	Sg + Ps	Sg + ání	Gloss
(37)	ágɔ̰:l	ágɔ̰:lɛ̄	ágɔ̰:lání	scarecrow
(38)	bù:r	bù:rɛ̄	bù:rání	grave
(39)	gɔ́:l	gɔ:lɛ̄	gɔ:lání	wild dog

	Sglt	Sglt + Ps	Sglt + ání	Gloss
(40)	àdè:rɔ̀	àdè:rɛ̄	àdè:rání	donkey
(41)	gɔ:lɔ̀	gɔ:lɛ̄	gɔ:lání	hook
(42)	ɗɔ̰:lɔ̰	ɗɔ̰:lɛ̄	ɗɔ̰:lání	ring of grass

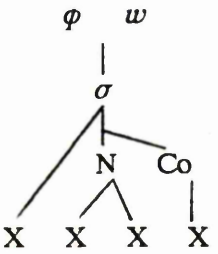
Verbs	C-ob	C-opt	Gloss
(43)	kwa:n	kwa̰:n	to count
(44)	cwɔ̰:ŋ	cwɔ̰:ŋ	to delay
(45)	ma:r	ma̰:t	to love

It is interesting that these words *never* have a root-final geminate. It is as though the doubled vowel had some dominant characteristic such that the vowel stays intact while the 'extra' consonant is not allowed phonetic realization. Certainly in the ASL words, the vowel is shortened in a closed syllable and a root-final consonant may geminate. With the IL vowel words, the vowel has precedence. For this reason, it seems logical to reflect this difference in the syllable structure. Thus, the second template, viz. (10b), is suggested.

Words of this type constitute a much smaller class. The assumption here is that they are marked in the Underlying Representation as words which have a complex nucleus so that both vowels are pre-associated with a single nucleus. In no case can either vowel be delinked. This set of words is referred to as the Invariably Long Vowel words (IL) and each must be marked in the Underlying Representation as being of this type.

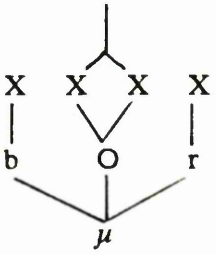
We have seen in our syllable hierarchy that CVVC syllables of this type are the most marked. We need to add a qualifier to this template to indicate that the full form (CVVC) may only occur word finally.

(46) Marked Vowel Coda Constraint

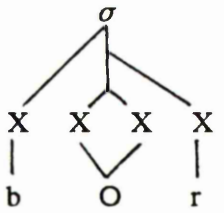


Returning now, to the syllabification of Invariably Long Vowel Words, we have the following process.

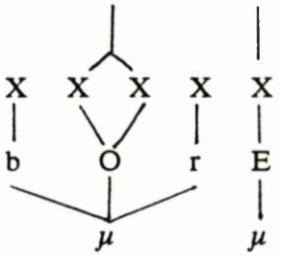
(38a)



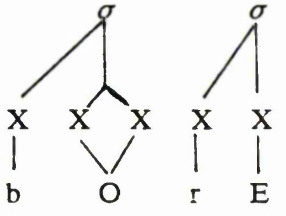
Syllabifies to



(38b)

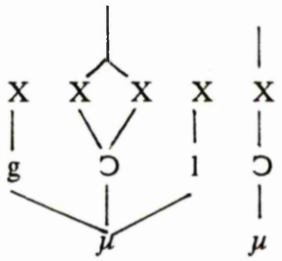


Syllabifies to

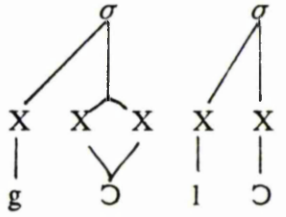


Similarly,

(41a)



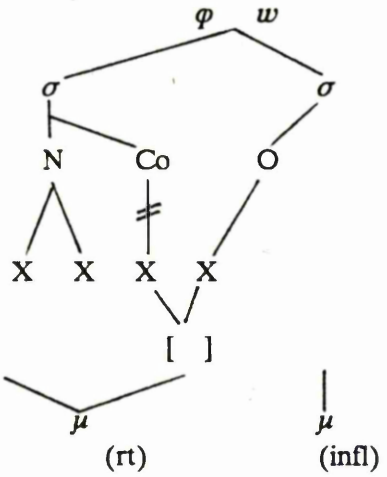
Syllabifies to



When we begin to examine the inflected form of the Sglt, we find an interesting development in the derivation. In previous examples with ASL vowel words, we saw that geminate consonants were accommodated by fitting the first consonant into the coda slot (via the CSP) and the second into the onset of the next syllable. However, with IL vowel words, this arrangement is not acceptable. Geminate vowels and consonants

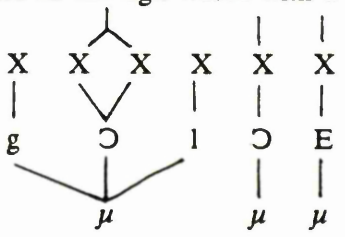
cannot co-occur in the same root since this would violate the constraint in (36). The solution to this incompatible situation is to delink the coda slot. The Coda Delinking Rule is given below.

(47) Marked Vowel Coda Delinking (MVCD)



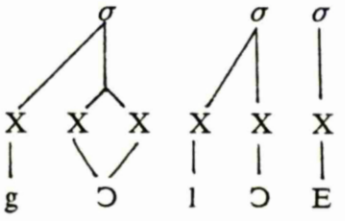
The MVCD Rule applies to syllables with a branching or marked nucleus. If in the course of the derivation, a geminate consonant arises, the coda must be delinked. Then the segmental feature matrix is delinked from the Timing Tier by the Segment Delinking Convention; thus allowing the structure tc be properly syllabified. Below we see how this rule applies in one of the Sglt words with a possessive inflection.

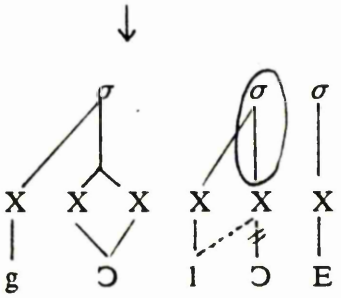
(41a)



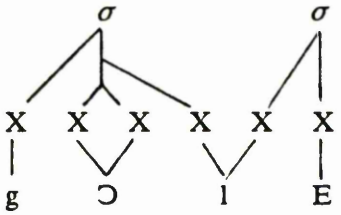
Syllabification
would violate PWL

*

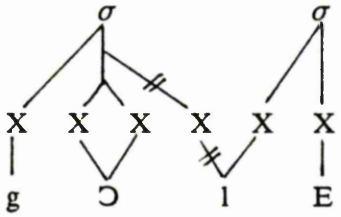




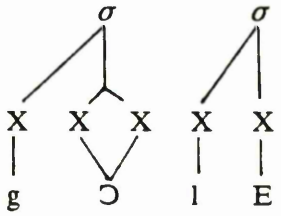
DSHP and VD



Re-syllabification
would violate MVCC



MVCD and SDC

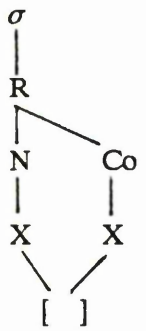


Surface Form

4.5.4 Comparison of Two CVV Templates

Let us look again at the two templates for a CVV syllable structure set up in Section 4.2.

(10a)



(10b)

In the structure shown above, both 10a and 10b have CVV patterns. We know from previous discussion that 10a will often surface as a short vowel. However, if there is no C_2 in the syllable, the vowel assigned to the two X slots will surface as a long vowel. Likewise, if the phonological word ends in a vowel, then the root vowel will surface as a long vowel. Only when the phonological word ends in a consonant or is followed by a further (CV) syllable will the root vowel surface as a short vowel.

By contrast, the vowel in 10b will always surface as a long vowel. It cannot be shortened in any context. There is no way to predict the occurrence of words with the syllable structure shown in 10b. Therefore, it is necessary to indicate the syllable structure of these IL vowels in the Underlying Representation.

4.5.5 Further Evidence

In Section 4.5.3, it was mentioned that the syllable pattern CVVC could only occur word-finally. This string is also the maximum allowed in a Shilluk syllable. Therefore, it would not be unreasonable to expect the system to 'feel a bit strained' at this point, and in fact, it does. Consider the following words.

	Word	Word + ání	Gloss
(48)	ŋù:	ŋù:rání	lion
(49)	kī:	kī:rání	Nile River
(50)	cū:	cū:rání	bones
(51)	kù:	kù:rání	thief

Note that in the citation form there is no final consonant. Yet, when these words are inflected, a root-final consonant appears; namely, [r]. While the final consonant in these words is consistently an 'r', they do stand in contrast to words which maintain the final 'r', but have a different syllable structure such as: [cur] 'type of catfish (pl)', and [anir] 'scum from water'.

Presumably, the underlying structure for a word like [ŋù:] is /ŋuur/ (the plural is [ŋúr:ī]). However, the CVVC syllable structure reduces to a simpler CVV. Again, we see that the vowel length is retained rather than allowing the final consonant to surface.

But why does this occur only with a root-final segment which is [+Vib]? The answer to that lies partly in the fact that in some dialects the [+Vib] is no longer a distinct phoneme. In these dialects the [+Vib] phoneme merged with the [+Rd,+Voc] glide. Perhaps this weakening of the phonemic status in certain dialects is generally indicative that it is a less 'stable' consonant. Perhaps such an intrinsically weak segment combined with the complexity of a CVVC syllable structure results in a loss of the C_2 when the C_2

is [+Vib]. The same 'pressure' would not be present in a word with the 10a structure. Thus, the [+Vib] surfaces in those words (in the majority of dialects where it is still a phoneme). In the inflected form, the final C survives because it can fit into the onset slot of the following syllable. Thus, if a superheavy syllable reduction process were to be underway, the [+Vib] segment would be a logical place to begin. We may conclude, then, that these words offer us some further evidence that our hypothesis for a second type of syllable template which is phonologically marked may well be valid.

4.6 Plural Forms

Up to this point, we have only dealt with Singular and Singulative words. Now we take up the plural words which for the most part, make use of the same rules as the singulars just discussed. Plurals, however, will need to be dealt with somewhat independently since they are not derivable from singulars. Derivations of (or rather the inability to derive) singular/plural words have been dealt with in more detail in Chapter Three. However, further evidence for this claim of independent underlying representations will be made in this chapter. As previously, the term Collective (Coll) will be used for the morphologically unmarked plural form as it relates to its semantic function and is more easily distinguished from the morphologically marked Plural (Pl).

4.6.1 Collective Words

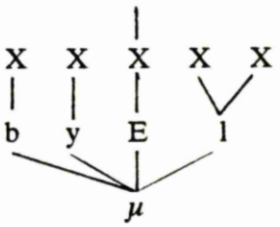
Collective (Coll) words in Shilluk usually have the shape CVC. Like the Sg forms, Coll are neutral with regard to number. They have no number suffix. In most cases, Coll words have a Sglt counterpart.

In the Sglt forms of nouns, we saw that geminate consonants appeared as part of the derivation. However, for these Coll words, it would seem necessary to posit a root-final geminate in the UR. Let us consider the following examples.

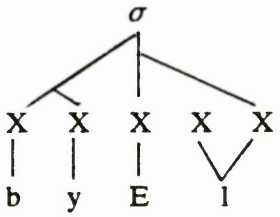
	UR	SR			
		Coll	Coll + Ps	Coll + ání	Gloss
(52)	/byell/	byél	byél:é	byél:ání	millet
(53)	/ciŋŋ/	cíŋ	cíŋ:é	cíŋ:ání	hand
(54)	/alepp/	álèp	álèp:é	álèp:ání	African Darter

Upon examination of the data, we see one CVC form (in the citation form) and one CVCC form (the inflected one). The reader may recall that, in the derivation of an inflected Sglt word (21b), the -ɔ suffix was delinked and the root-final consonant was allowed to spread to that X slot. The phonetic realization is a root-final geminate consonant. It would simplify the analysis if a similar sort of derivation could be set up for the Coll words. However, since Coll words have no number suffix, there is nothing from which to derive a root-final geminate. Given this situation, it seems necessary to posit a root-final geminate in the UR. When syllabification applies, the CSP will assign the coda to the final unassociated X slot. The penultimate X slot will not appear on the surface since any unsyllabified element cannot have a phonetic realization. The result is a single root-final consonant word finally, but a geminate root-final consonant intervocalically. Consider the derivation shown below.

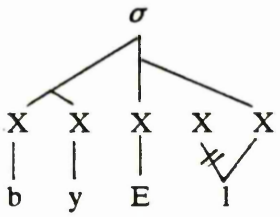
(52a)



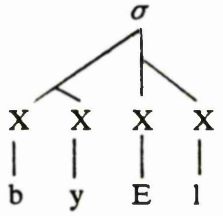
Syllabification would violate BCC CSP



SDC

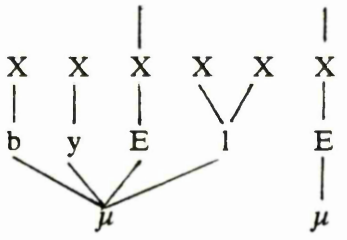


Surface Form

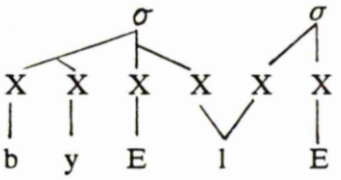


Having allowed for the root-final geminate in the UR, syllabifying the inflected form presents no difficulty.

(52b)



Syllabifies to



As innocent as this solution may appear, we will find that the implications are striking. If this analysis is accepted, and I do not see a viable alternative to it, then the UR's for singular and plural are structurally different. The Sglt, in this case, has a single

root-final consonant while the Coll has a geminate root-final consonant. Let us consider the two together.

	Coll	Coll + Ps	Sglt	Sglt + Ps	Gloss
(55)	byel	byel:e	bye:lɔ	byel:e	millet

Without the geminate in the UR of the Coll, we see the following derivation.

	Coll /byEEl/	Coll + Ps /byEEl + E/	Sglt /byEEl + Ↄ/	Sglt + Ps /byEEl + Ↄ + E/
DSHP	———	———	———	byeelle
CSP	byel	———	———	byelle
SF	[byel]	*[bye:le]	[bye:lɔ]	[byel:e]

We see that there is no way to get a geminate consonant in the inflected Coll form without positing its presence in the UR. As a result of failing to posit such a structure, the root vowel remains long when it should be shortened.

If the geminate is posited in both Coll and Sglt, we see further problems.

	Coll /byEEll/	Coll + Ps /byEEll + E/	Sglt /byEEll + Ↄ/	Sglt + Ps /byEEll + Ↄ + E/
DSHP	———	———	———	byeelle
CSP	byel	byelle	byellɔ	byelle
SF	[byel]	[byel:e]	*[byel:ɔ]	[byel:e]

If the root-final geminate is in both forms, then it ought to appear in the citation form of the Sglt, which is incorrect.

If, however, we allow for this structural difference between Sglt and Coll, the derivation works satisfactorily. It will be recalled that such a conclusion is independently motivated on account of substantial differences between the two root forms which, it was claimed, present insuperable problems to morpheme invariance; see 3.2.2 and 3.3.

	Coll /byEEll/	Coll + Ps /byEEll + E/	Sglt /byEEl + Ↄ/	Sglt + Ps /byEEl + Ↄ + E/
DSHP	———	———	———	byeelle
CSP	byel	byelle	———	byelle
SF	[byel]	[byel:e]	[bye:lɔ]	[byel:e]

Thus, we see that a root-final geminate needs to be posited in the UR for Coll words, but *not* posited for the Sglt words. This further evidence for the claim of independent UR's does not stop here, however. We move on now to the Plural words.

4.6.2 Plurals with -I Suffix

In contrast to the Coll words discussed above, there are Plural (Pl) words. These words typically have an -i suffix as a plural marker. They often have a Sg counterpart, but may have a Sglt in some cases.

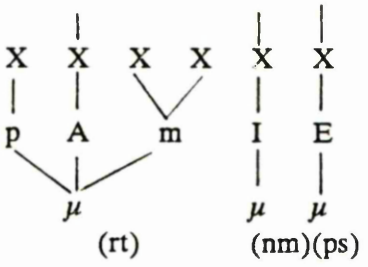
The pattern of these Pl words is to have a geminate root-final consonant and the -i plural marker in the citation form. See the examples below.

	Pl	Pl + Ps	Pl + ání	Gloss
(56)	pa̱m:i̱	pa̱m:é	pa̱m:ání	sawn timber
(57)	la̱n:i̱	la̱n:é	la̱n:ání	chieftainship
(58)	θól:ɪ	θól:é	θól:ání	snake

Presumably the UR would be similar to the Coll form with a root-final geminate. The Pl, however, would also include the -i suffix. The derivation would look as follows.

	/pAmm + I/	/pAmm + I + E/
DSHP	————	*pammme
CSP	————	pa̱mme
SF	[pa̱m:i̱]	[pa̱m:e]

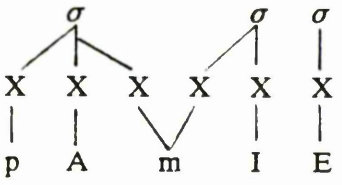
In the course of the derivation, the delinking of the -i suffix (as a result of DSHP) could be assumed to prune the syllable head associated with the plural suffix. The plural suffix would then be delinked and the root-final consonant allowed to spread to that X slot. However, in the syllabification process, the CSP would only allow two of those consonants to surface. The third could not be syllabified and thus would receive no phonetic realization.



↓

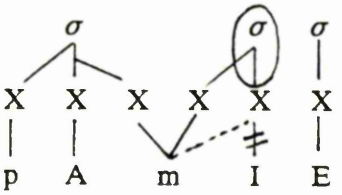
Syllabification would violate PWL

*



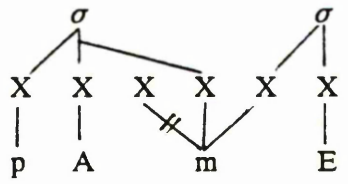
↓

DSHP and VD



↓

Re-syllabification and CSP, SDC



[pa̱m:e] 'his sawn timbers'

It is not clear whether the UR has a double vowel (ASL) or an IS vowel. By comparison with the singular words there seems to be a significant difference in the frequency of occurrence between ASL and IS. In the singulars, most words come from the ASL set. However, in the plural, most words seem to come from the IS set. One explanation for this could be that both ASL and IS words surface as single vowels because of the gemination of the final consonant. The ASL words are then automatically reduced or simplified, thus giving the impression that plural words have a significantly higher proportion of IS words. As can be seen from the derivations below, the result is the same with either analysis.

(56a)	UR	/pAAmm + I/	or	/pAmm + I/
	CSP	pAmmI		———
	SF	[pa̱m:i̱]		[pa̱m:i̱]

We come again to the question of UR for Sg and Pl words. If we assume, for the sake of convenience, that both Sg and Pl forms have an ASL vowel in the root, we would *still* need to allow for a doubled root-final consonant in the Pl form. Consider the alternatives.

	Sg	Sg + Ps	Pl	Pl + Ps	Gloss
(60)	pà̱m	pà̱:mē	pá̱m:ī	pá̱m:é	sawn timber

We have the following derivation without the root-final geminate.

	Sg	Sg + Ps	Pl	Pl + Ps
UR	/pAAm/	/pAAm + E/	/pAAm + I/	/pAAm + I + E/
DSHP	———	———	———	*pAAmmmE
CSP	pAm	———	———	pAmmE
SF	[pa̱m]	[pa̱:me]	*[pa̱:mi̱]	[pa̱m:e]

The Pl form is incorrect because there is no root-final geminate. Further, since there is no geminate consonant, the syllable is open and the vowel remains long.

If we include the root-final geminate in both forms, the reverse problem appears.

	Sg	Sg + Ps	Pl	Pl + Ps
UR	/pAAmm/	/pAAmm + E/	/pAAmm + I/	/pAAmm + I + E/
DSHP	———	———	———	*pAAmmmE
CSP	pAm	pAmmE	pAmmI	pAmmE
SF	[pa̱m]	*[pa̱m:e]	[pa̱m:i̱]	[pa̱m:e]

The geminate in the inflected Sg form reduces the vowel and leaves the geminate consonant resulting in an incorrect form. The point at issue here is that, two distinct results must be achieved given identical syllable patterns. We must recognize this requirement as impossible unless there is an underlying structural difference between them. The conclusion, then, is that the Pl has a root-final geminate consonant which is not present in the Sg.

	Sg	Sg + Ps	Pl	Pl + Ps
UR	/pAAm/	/pAAm + E/	/pAAmm + I/	/pAAmm + I + E/
DSHP	———	———	———	*pAmmmE
CSP	pAm	———	———	———
SF	[pa̲m]	[pa̲:mĕ]	[pa̲m:ĭ]	[pa̲m:é]

One other solution to this dilemma seems possible. Perhaps the plural marking is C + i. The C would be unspecified and would take on the feature matrix of the root-final consonant. This solution would provide the necessary structure for a correct derivation. Only one problem remains, viz., the Coll words are unmarked for Pl and yet a geminate consonant is present in the UR. Without positing different UR's for Coll and Pl words, this solution does not seem to be viable. It is unlikely that geminate-final consonants are present only in Coll words and are added as a Pl marker in all the other plural nouns.

Thus, it seems we are forced to posit a geminate root-final consonant in the plural words whether morphologically marked (Pl) or unmarked (Coll). This geminate consonant is not to be found in the UR of the singular nouns. Once that basic assumption is in place, the rules are quite orderly and systematic. Without the two forms, confusion reigns. So, to give proper credit to my predecessors, as they advised, it is necessary to learn both underlying "singular" and "plural" forms and then one can more easily become "acquainted with the rules governing the regular nouns" (Anon., 1935).

4.6.3 Derived Plurals

The next set of words under consideration are the derived plurals.

	Pl	Pl + Ps	Pl + ání	Gloss
(61)	gɔ̰:r	gɔ̰r:é	gɔ̰r:ání	Honey Badger
(62)	yɛ̰:p	yɛ̰p:é	yɛ̰p:ání	tail
(63)	bä̰:k	bä̰k:é	bä̰k:ání	garden

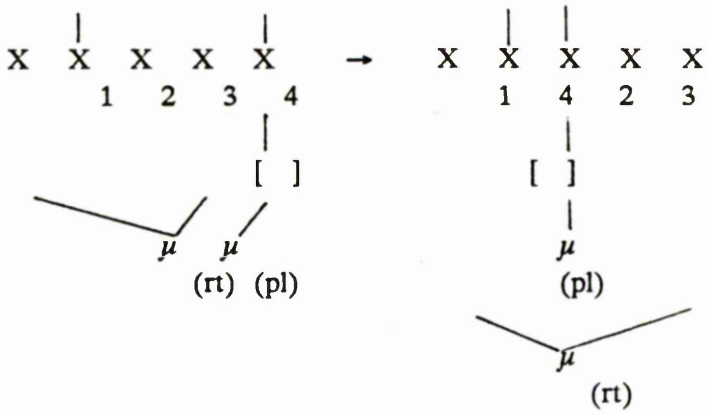
The older plural process is root + i. However, there seems to be a movement within Nilotic languages toward becoming monosyllabic. Dinka has already become almost exclusively monosyllabic. And, at least within the plural formation, Shilluk is also losing suffixes. This process is currently in progress and some dialects, age groups, etc. choose one rule and some the other for forming plurals. Some people argue with themselves over which way sounds 'right' for a particular word.

One Shilluk has reported to me that children learning the language will use the root + i for plurals on every word. Furthermore, he said that as they grow older, they use the alternative form as described by the metathesis rule given below. While I have not

been able to personally observe this behavior, it would be an interesting confirmation for this hypothesis.

The Plural -I Incorporation Rule or Metathesis Rule is optional—depending on the factors mentioned above. It could be hypothesized that there is a metathesis rule which moves the plural -i marker into the nucleus of the root. In the process, it changes the syllable structure of that form so as to create the marked long vowel (i.e., with complex nucleus).

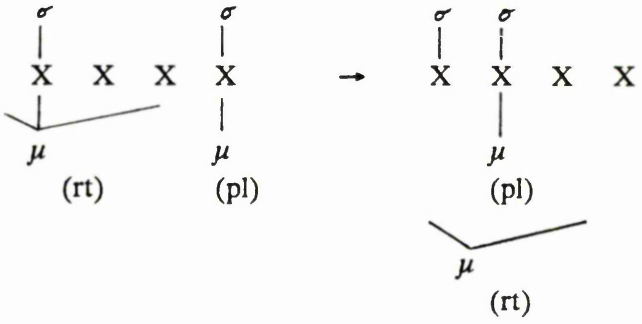
(64) (Optional) Plural Metathesis Rule (PMR)



It is interesting to note that this mono-syllabification process occurs with the -i suffix in plural words. Later in this chapter (Section 4.7.2), we will see the same process with the -i suffix in the verbs. Since it seems that there is a consistently motivated series of steps at work here, it behooves us to examine it more closely.

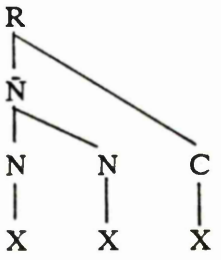
The process of mono-syllabification or 'I-Incorporation', as it will be termed in this thesis, is composed of several steps. First of all, the X slot associated with the plural number marker is moved into the root so that it is contiguous to the root vowel. This movement can be shown on the Vowel Plane as follows.

(65) Syllable Head Movement (SHM)

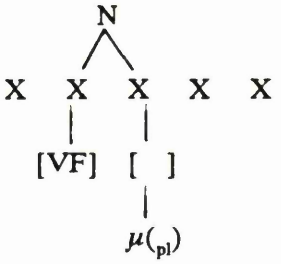


After SHM has occurred, the two vowels are united into a complex nucleus by means of Chomsky adjunction. I will call this step Nuclear Adjunction.

(66) Nuclear Adjunction (NA)

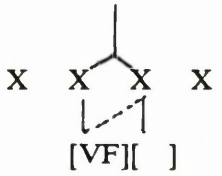


This results in a complex nucleus.



In Chapter Two, the maximally underspecified vowel for Shilluk was said to be [i]. Since this vowel would normally receive no feature content until the final stages of the derivation, it is not surprising that, in the course of adjunction, this unspecified segment takes on the features of the root-vowel with which it is joined. This assimilation process is shown in (67).

(67) Root Vowel Spreading Rule (RVSR)



Viewing the I-Incorporation Process (IIP) in this way eliminates the need for the Metathesis Rule. Furthermore, it explains why this process *only* occurs with the [i] vowel since the -I's maximally underspecified status makes it the best candidate for a total assimilation to the root vowel. Through this process, we can also see that the morphological information of the -i suffix is retained in the word (by means of the long root vowel) even though the suffix *per se* is no longer present. Finally, the IIP explains why there is a long vowel in a closed syllable in ASL words which typically cannot have that combination.

In Chapter Five, we will see that the Number Marker receives its [Ex] value from the root vowel. As such, we would not expect to have any [Ex] feature change as a result of the IIP, and in fact, there is no change of the [Ex] feature resulting from the process. The tone on the plural marker, however, is incorporated into the root. One

speaker gave the following two alternatives for the plural of 'grasshopper':

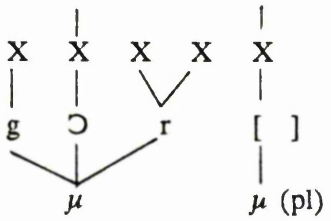
bâ:ɲ ~ bán:ì

Thus, instead of losing the tone or having a floating tone, the incorporated vowel moves the tone into the root along with the syllable head. Therefore, the IIP would seem to offer an explanation for the unusually high number of instances of tone sequences in derived Plural words. For a further discussion of tone in derived plurals see Section 5.1.4.3.

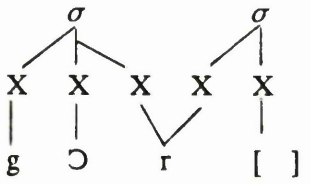
In conclusion, we have now seen two ways in which contiguous syllable heads are dealt with in Shilluk. First, if the number suffix and another inflection are involved, the DSHP Rule is implemented, ultimately resulting in a root-final geminate consonant. On the other hand, if the number suffix is moved into the root (IIP) the result is a change in syllable structure which produces an Invariably Long vowel in the citation form of the plural.

In the derivation given below, the steps of the IIP are shown. Once IIP has applied, the CSP will fail to syllabify one of the root-final geminate consonants. The SDC will prevent it from appearing on the Surface.

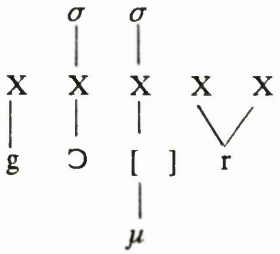
(61a)



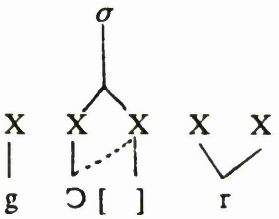
↓ Syllabification



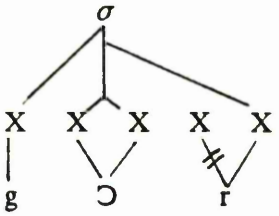
↓ IIP:SHM



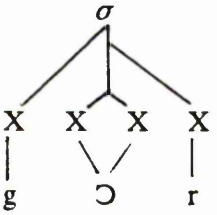
↓ NA, RVSR



CSP,SDC Re-Syll

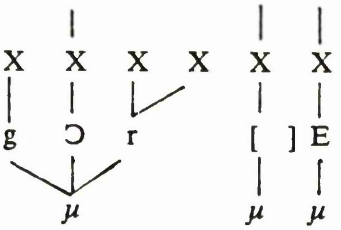


Surface Form



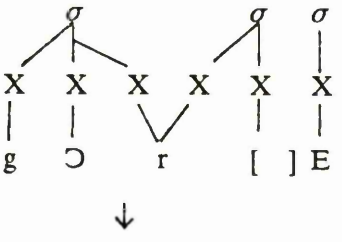
Inflected form:

(61b)

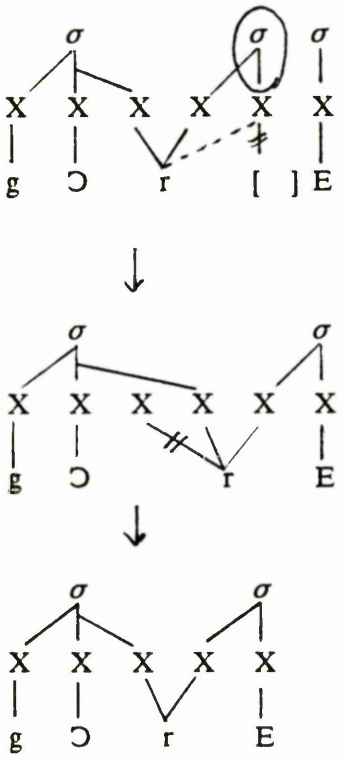


Syllabification
would violate PWL

*



DSHP, and VD



4.6.4 IL Plurals

In Section 4.6.2, it was shown that ASL and IS vowel words appear to be identical on the surface. These words stand in contrast to the IL vowel words discussed here. From our discussion of Sglt words, we recall that gemination of consonants may not co-occur with the IL vowels. Consider these examples.

	Pl	Pl + Ps	Pl + ání	Gloss
(68)	kwe̱:rì	kwe̱:ré	kwe̱:rání	small hoe
(69)	bo̱:θì	_____	bo̱:θání	craftsman

	Pl	Pl + Ps	Pl + ání	Gloss
(70)	cɔ̱:r	_____	cɔ̱:rání	blind person
(71)	ápè:d	ápè:dé	ápè:dání	skunk
(72)	dú:p	_____	dú:pání	swamp rat

The root vowel is assumed in these cases to be marked as a long vowel. The derivations would involve the Marked Vowel Coda Delinking Rule which eliminates the first of the geminate root-final consonants.

(68)	UR	/kwEErr + I/	/kwEErr + I + E/
	DSHP,VD	_____	*kweerrre
	MVCD,SDC	kweeri	kweere
	SF	[kwe:ri]	[kwe:re]

(60)	UR	/cƆƆrr/	/cƆƆrr + AnI/
	CSP,SDC	cɔɔr	————
	MVCD,SDC	————	cɔɔrani
	SF	[cɔ:r]	[cɔ:rani]

The geminate consonant posited in the UR is a fairly abstract entity since it never surfaces with these words. However, as root-final consonant gemination appears to be a consistent feature of plural, it seems reasonable to include it by analogy with IS and ASL words.

4.6.5 Morphemic Status for Templates and Syllable Structure

In our discussion of nouns, we have seen that the semantically singular forms have a root-final consonant while the semantically plural forms have a root-final geminate consonant. Within the framework of the non-linear model, the timing tier or prosodic template is the tier into which this morphological information is coded. The C and V tiers simply attach to the appropriate X slots by Universal Association Conventions. Thus, we may conclude that the prosodic template has morphemic status as was claimed by McCarthy (1982). In Shilluk, then, the 'extra' X slot to which the root-final consonant attaches signals that that form is semantically Plural.

It is also suggested that syllable structure may have morphemic status. In the previous sections, it has been shown that virtually nothing is predictable between the singular and plural forms of a word. However, nothing has been said specifically about syllable structure. In fact, syllable structure cannot be predicted either. While the syllable structure often seems to be the same between Form 1 and Form 2, there are instances where one form (usually the semantically singular) will have an IL vowel and the other (usually the semantically plural) will have either an IS or ASL vowel. Below are examples.

	Sg	Sg + ání	Pl	Pl + ání	Gloss
(73)	áyɛ̄:r	áyɛ̄:rání	áyɛ̂r:ì	áyɛ̂r:ání	Curlew bird
(74)	átê:gɔ̀	átê:ŋání	átè:k	átèk:ání	goat
(75)	bù:r	bù:rání	būr	būr:ání	grave
(76)	cò:gɔ̀	cò:ŋání	cōk	cōk:ání	Eel-like Catfish

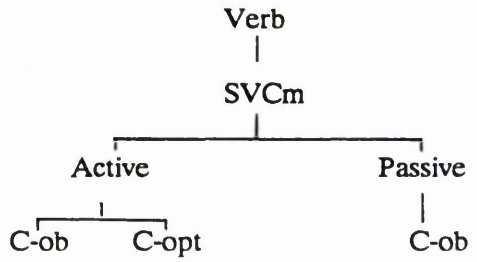
In these examples, the Sglt forms, if they were ASL or IS vowel words, would have a geminate root-final consonant in the inflected form. However, we see that these words do not have a geminate consonant. Instead, the vowel stays long in both the citation and inflected forms. On the other hand, the 'Plurals' of those words conform to the patterns expected for IS and ASL vowel words. Thus, I conclude that syllable structure also seems to have morphemic status.

4.7 Verbs and Syllable Structure

In Chapter Three, we saw several forms of verbs. Besides Active and Passive, there were the C-ob and C-opt forms. The examples of these various forms will be repeated here for the convenience of the reader. Following the examples, the verb itself will be examined in light of the syllable structure rules just discussed.

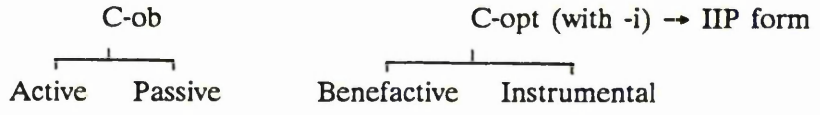
(3.29)	ja:l dwɔŋ yep:a ɗɔ ɔt.	'The man opens the door.'
(3.31)	ɗɔ ɔt yep yi ja:l dwɔŋ.	'The door is opened by the man.'
(3.47)	yá yep:a ɗɔ ɔt.	'I opened the door.'
(3.48)	ya yɛ:p.	'I opened (it).'
(3.49)	ya yɛp:í meya.	'I opened (it) for my mother.'
(3.50)	ya yɛ:ba tɔŋ.	'I opened (it) with a spear.'

First, from Chapter Three, there were three word orders given for Shilluk. This discussion will concentrate on the SVCm order.



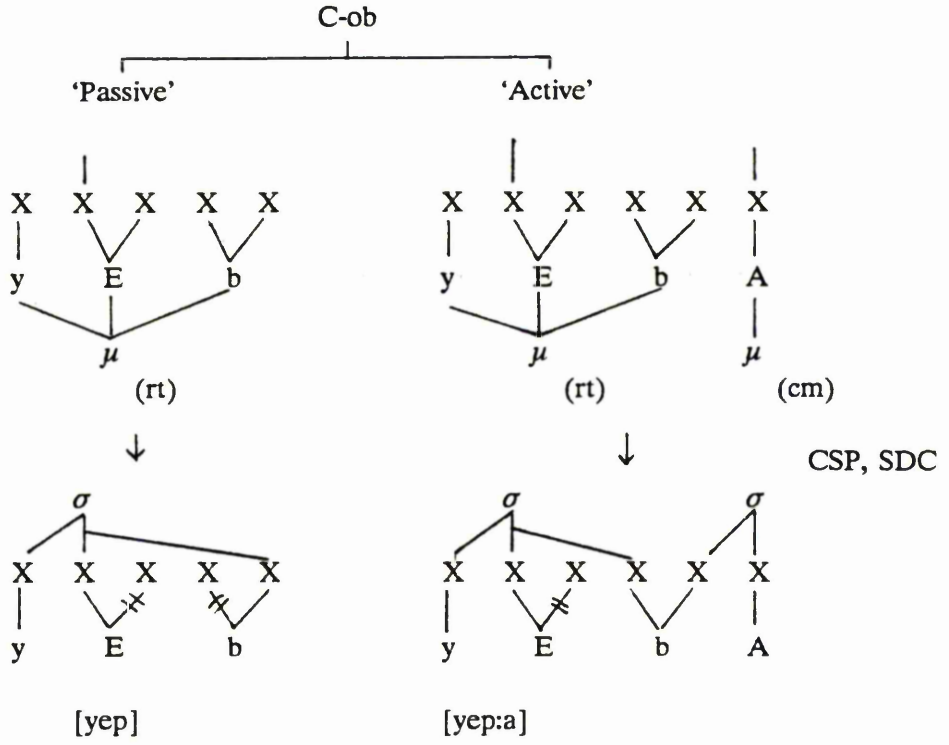
According to the conclusions drawn earlier, independent underlying representations must be posited for the C-ob and C-opt forms. From those two forms, however, we should be able to derive other forms. Syllable structure will play an important role in our derivations.

Notice that the C-ob form is used for both 'Active' and 'Passive' voice. The C-opt allows no complement. However, we will see that, like the Plurals, the C-opt may come in two versions: Root + -i, and an incorporated version. The discussion that follows will show that the IIP is not limited to the nominal system, but is also used in the verbs. Finally, the C-opt form can be used as the basis for deriving the Benefactive and Instrumental verb forms.



4.7.1 C-ob Active and Passive Verbs

First, consider the C-ob from which the Active and Passive of the SVCm order is derived. If an ASL vowel is posited in the UR along with a root-final geminate consonant, we have the following derivations for [yep], [yep:a] 'to open.'



The Active C-ob form always has the -a Complement marker. The Passive form has no Complement marker. Therefore, when the syllable structure rules apply; namely, the CSP, the surface forms are quite different. Underlyingly, though, they have a common root.

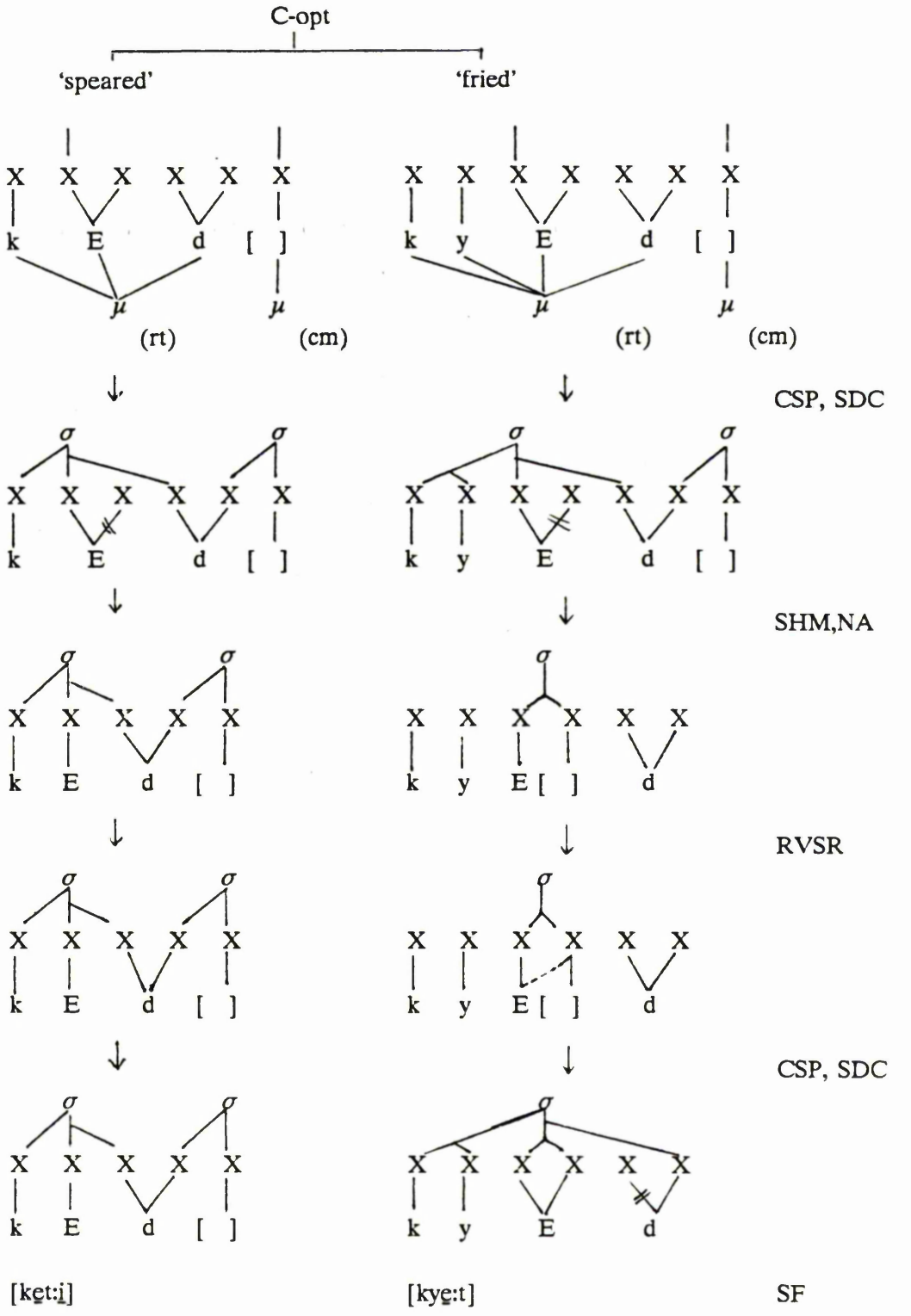
In order to syllabify the 'Passive' form, the CSP must apply. In this case, one vowel and one consonant are not able to be realized phonetically since they cannot be syllabified. The various Post-lexical Tensing and Intervocalic Aspiration Rules would apply though the steps are not shown here.

4.7.2 C-opt Verbs

Now, we turn our attention to the C-opt forms. Interestingly enough, we encounter the same situation here as we did for the plural nouns. There seems to be an inconsistent I-Incorporation Process in operation. Consider these words.

	C-opt	Gloss		C-opt	Gloss
(73a)	kɛ̱t:i̱	____ speared	(73b)	kyɛ̱:t	____ fried
(74a)	yɛ̱y:i̱	____ answered	(74b)	wi̱:y	____ left (it) alone
(75a)	gɔ̱c:i̱	____ hit	(75b)	gɔ̱:k	____ worked
(76a)	mą̱k:i̱	____ summoned	(76b)	bą̱:k	____ boiled

There is a striking similarity between the structure of these two forms and that of the plurals. It seems that IIP is at work here too, but has not yet affected all the words in the lexicon. For the derivation of these words, we may assume an ASL vowel and geminate root-final consonant. The derivation would also work for IS words, but the ASL words are slightly more complicated, and so were chosen for the examples.



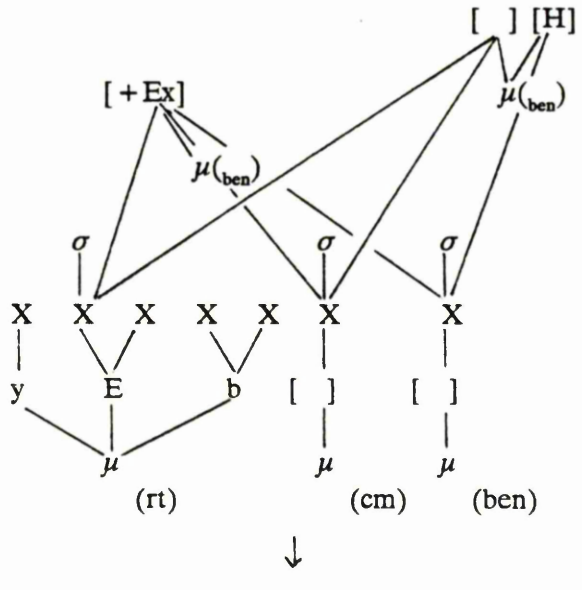
In the derivation, the CSP is used to syllabify the string, effectively shortening the root vowel in both forms. It will be shown in Chapter Five that IIP is a later rule within the Lexical level. Syllabification is assumed to be perseverative and is not specifically ordered in this derivation.

The IIP involving Syllable Head Movement and Nuclear Adjunction takes place with 73b, but not 73a. Again, the underspecified vowel takes on the feature complex of the root vowel with which it shares a syllable head. The root-final geminate surfaces as a single consonant because of the application of the CSP and SDC. At the post-lexical level, devoicing of the plosives occurs in both words.

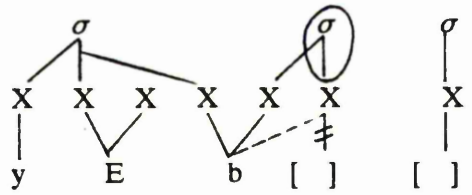
4.7.3 Benefactive Verb Form

We come now to the Benefactive form of the verb. The suffix -i indicates Benefactive. If that -i is combined with the C-opt suffix -i, then according to the rules set up to this point, the derivation would result in triple consonant length. Of course, by the syllabification rules for Shilluk, this triple consonant length would not be allowed to surface. The CSP would not syllabify one of the consonants, and thus, only two would be able to receive phonetic realization. This case in the verbs is parallel to the one in the plural nouns in Section 4.6.2 and 4.6.3.

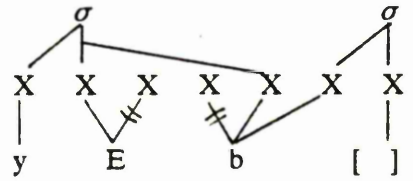
There are certain elements such as tone and [Ex] that are characteristic of the Benefactive form. The tone on the Benefactive is consistently a M root tone followed by a H suffix tone. This M-H sequence is not found on any other verb form of which I am aware. Therefore, it would suggest that tone has morphemic status. Furthermore, the Benefactive always has a [+Ex] vowels (both the root and the suffix). In all the other verb forms discussed up to this point, the [Ex] feature has been assigned to the vowel in the UR. However, in this case, the [Ex] feature seems to have morphological status since it consistently indicates the Benefactive form. The remaining characteristics of the Benefactive can be derived from the C-opt verb form as shown below. The C-opt form shown here is from example (3.49).



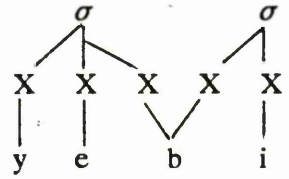
DSHP,VD



CSP, SDC



SF



[yɛ̱p:ɪ́]

The UR shows the C-opt form plus the -i Benefactive suffix. The DSHP rule applies allowing the syllable head associated with the Complement Marker to be pruned. The vowel features are not specified since we are dealing with the non-specified segment in this case. The root-final consonant spreads, but, as with previous examples, the resulting triple consonant length is never permitted to surface. The CSP and SDC shorten the root vowel and delink the third consonant from the timing tier. The [Ex] and tone morphemes are shown on separate tiers to indicate their morphological status. At the Post-lexical level, the rules regarding the voicing of plosives would apply, though I have not shown those steps here.

4.7.4 Instrumental Verb Form

Finally, we come to the Instrumental form of the verb. First, the characteristics peculiar to the Instrumental form include a consistent [+Ex] feature on the root vowel and a M tone on both root and -a suffix. Again, the tone and [Ex] features distinguish the Instrumental form of the verb and thus seem to function morphologically within the representation. The -a suffix is always [−Ex].

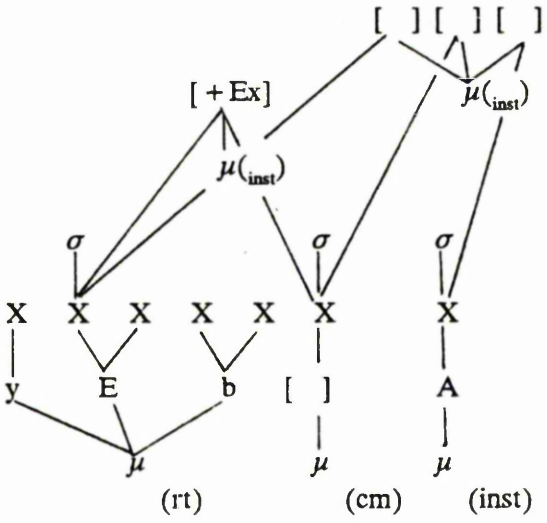
Structurally, the Instrumental form of the verb presents a slight problem. The root vowel surfaces as a long vowel and there is a single root-final consonant. The suffix vowel is -a. The Instrumental form is derived from the C-opt root. This can be seen from the examples below.

	C-ob	C-opt	Inst	Gloss
(78)	θal	tɑ̱:t	tɑ̄:dā	cook
(79)	kyel	kyɛ̱:t	kyɛ̄:dā	fry
(80)	wa:l	wɑ̱:t	wɑ̄:dā	boil liquid

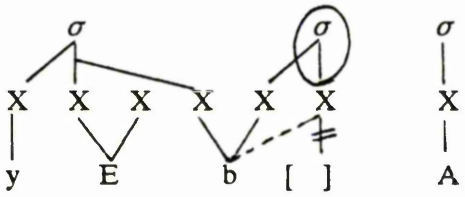
(81)	yep	yẹ:p	yẹ̄:bā	open
(82)	ŋɔl	ŋut	ŋūtā	cut up

Both the consonant alternation [θ~t] and the vowel alternation [ɔ~u] show that the Instrumental form is derived from the C-opt rather than from the C-ob.

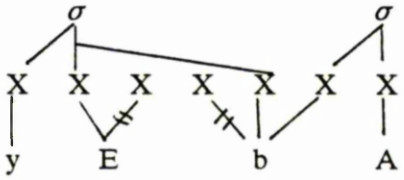
So, what is the difficulty that was mentioned above? Let us examine a derivation, again using the verb 'to open.'



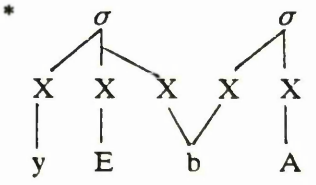
DSHP,VD



CSP,SDC



* Surface Form



*[yẹ̄p:ā] should be [yẹ̄:bā]

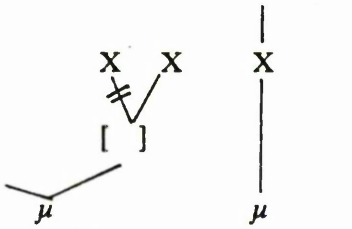
The Surface Form, however, has not come out as expected. The problem lies in the presence of the root-final geminate consonant. As long as the geminate is present, the CSP will shorten the vowel resulting in an incorrect surface form.

One alternative to handling this problem would be to omit one of the root-final consonants in the UR. This solution does not really help, however, because the DSHP rule would effectively create the geminate consonant from the X slot associated with the delinked suffix vowel -i.

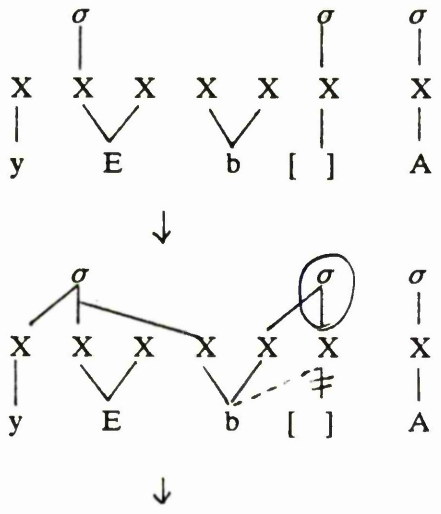
A second alternative would be to replace the -i suffix with the -a suffix. This solution is unworkable as well since the geminate consonants in the UR would remain in place. The root vowel would be shortened and the problem would remain.

The third solution presented here does produce the correct result. If a root-final consonant delinking rule is introduced after the CSP, then the correct surface form will result. The Root-Final Consonant Delinking Rule says that one of the root-final consonants is delinked and so does not receive any phonetic realization in the Instrumental form of the verb.

(83) Root-Final Consonant Delinking Rule (RFCDR)

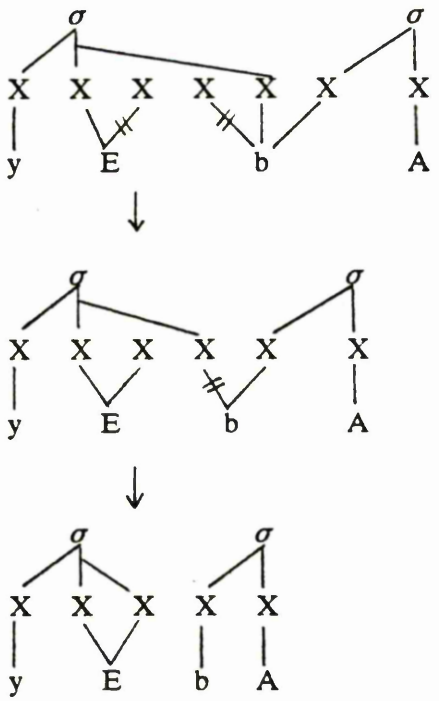


Consider the derivation below.



DSHP,VD

Re-syll, CSP,SDC



Presumably, when the SDC applies, the result does not eliminate the segment from the structure. As has been seen in this derivation, if the segment can be syllabified, then it is allowed to 'reappear'.

In order to fully discuss the derivations of the various forms of verbs, one would need to write an entire thesis on that topic alone. The small section included here is intended to highlight the fact that the rules established for the nouns apply equally to the verbs. Even the IIP is not solely found in plural nouns, but is a process that is also to be seen in the C-opt verb forms. Thus, we may conclude that there is independent confirmation in the verbal system for the syllable structure rules set up in this chapter to account for the nominal system.

4.8 Morphology

Throughout this chapter, we have seen affixes used to mark Sglt, Pl, Benefactive, etc. This use of affixation is common to Concatenative languages. In addition to affixation, we have seen infixation in both Pl and C-opt forms. Further, tone and another autosegmental feature, viz. [+Ex], mark the Benefactive and Instrumental. Such morphological features are typical of Non-concatenative languages. Since, in some cases at least, both morphological types occur in marking identical categories (e.g., Plural and C-opt), we can conclude that Shilluk is in a transitional stage from being a Concatenative language to becoming a Non-concatenative one. It has been "caught in the act".

4.9 Summary

In this chapter, we have seen that Shilluk syllable structure is one of the most powerful aspects of the phonology. Underlyingly, there are two syllable structures, one for IS and ASL vowel words, and the second for IL words.

Separate underlying representations are still required for Sg and Pl as well as C-ob

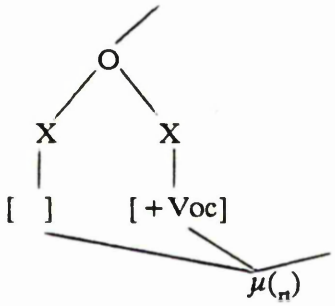
and C-opt forms. It has been shown that, in addition to other differences between these forms as discussed in Chapter Three, there are also underlying structural differences. For example, the Pl and Coll words must have a root-final geminate consonant in the UR which cannot be present in the Sg or Sglt forms. Further, the underlying syllable structure may be different in the two forms (Sg/Pl).

When the rules summarized below are applied to the UR's, words can be successfully derived. In the case of nouns, inflected forms, which at first glance seem to behave in an arbitrary fashion, can be derived in a straightforward manner. Utilizing the same set of rules, several verb forms can also be successfully derived.

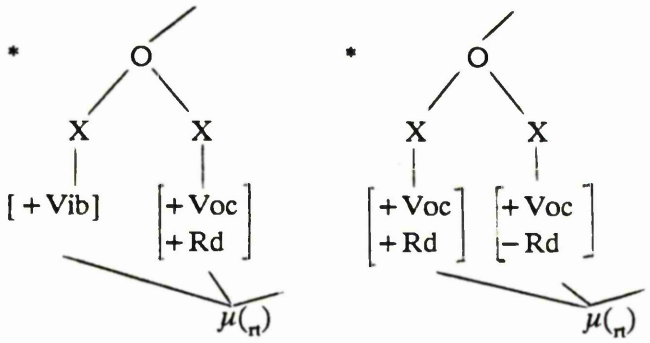
By utilizing syllable structure rules, it is no longer necessary to posit rules which will link or delink a consonant or vowel at crucial points. Instead, the syllable structure rules explain where these 'insertions' and/or 'deletions' will be and why they are there.

A summary of the syllable constraints, and rules are given below. First, the constraints and conventions.

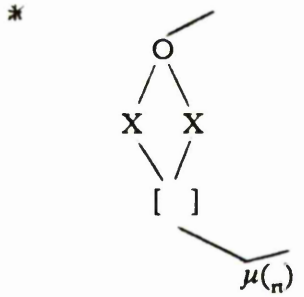
(2.78) Initial Consonant Sequence



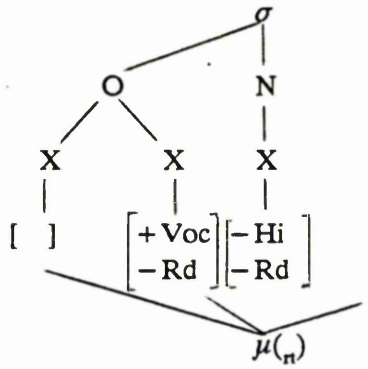
(2.79) Initial Consonant Sequence Constraint



(2.90) Initial Geminate Consonant Constraint

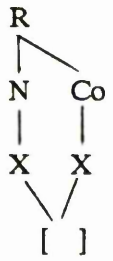


(2.80) Glide and Vowel Constraint

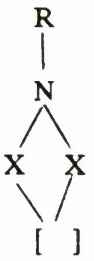


(12) Syllable Head Constraint

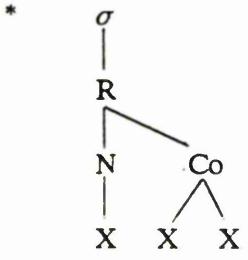
(10a)



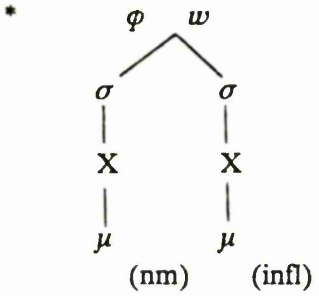
(10b)



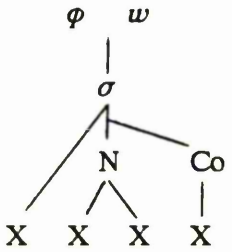
(14) Branching Coda Constraint (BCC)



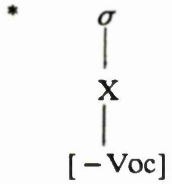
(35) Phonological Word Level Constraint (PWL)



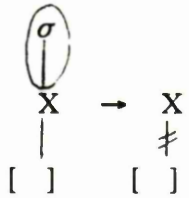
(46) Marked Vowel Coda Constraint (MVCC)



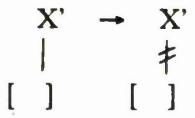
(13a) Vocalic Association Constraint (VAC)



(13b) Vocalic Delinking Rule (VD)

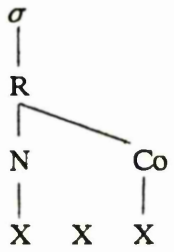


(16) Segment Delinking Convention (SDC)

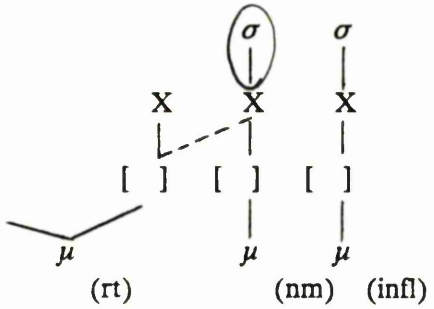


Rules:

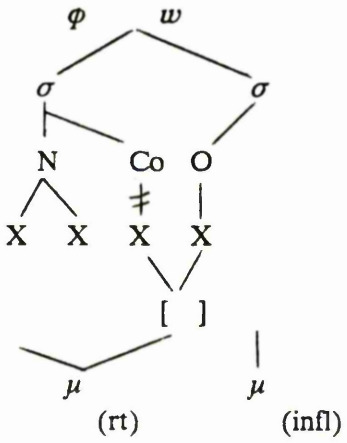
(15) Coda Syllabification (Rightmost Selection) Principle (CSP)



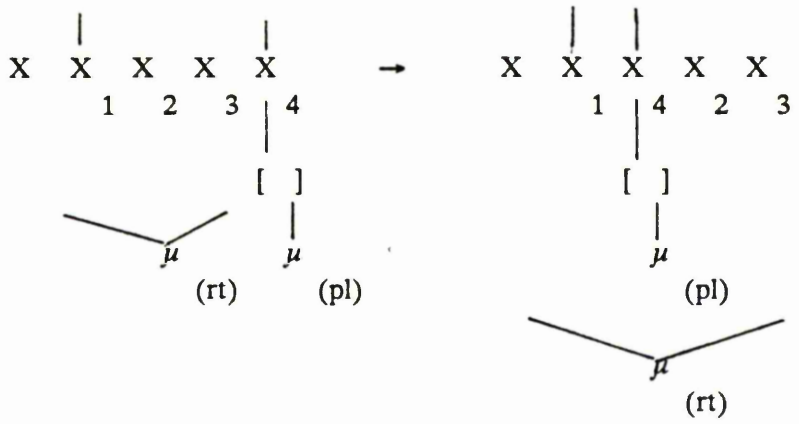
(36) Dual Syllable Head Pruning Rule (DSHP)



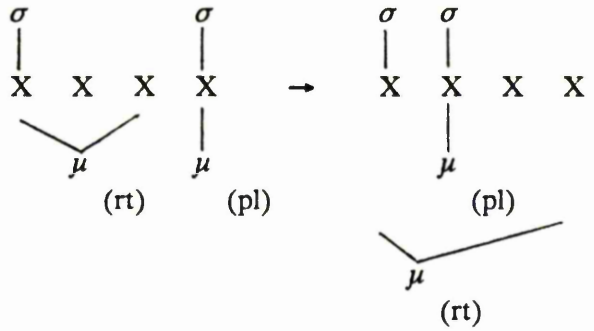
(47) Marked Vowel Coda Delinking (MVCD)



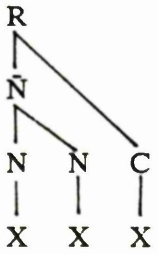
(64) (Optional) Plural Metathesis Rule (PMR)



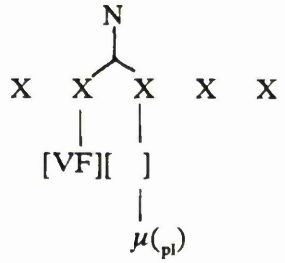
(65) Syllable Head Movement (SHM)



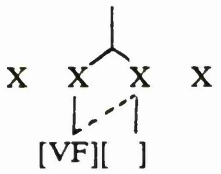
(66) Nuclear Adjunction (NA)



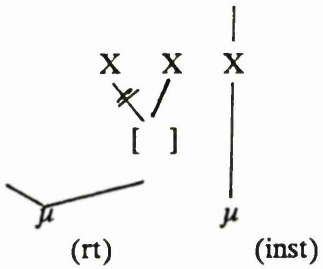
This results in a complex nucleus.



(67) Root Vowel Spreading Rule (RVSR)



(83) Root-Final Consonant Delinking Rule (RFCDR)



ABBREVIATIONS

BCC	(14)	Branching Coda Constraint
CSP	(15)	Coda Simplification Principle
DSHP	(36)	Dual Syllable Head Pruning Rule
MVCC	(46)	Marked Vowel Coda Constraint
MVCD	(47)	Marked Vowel Coda Deletion
NA	(66)	Nuclear Adjunction
PMR	(64)	Plural Metathesis Rule
PWL	(35)	Phonological Word Level Constraint
RFCDR	(83)	Root-Final Consonant Delinking Rule
RVSR	(67)	Root Vowel Spreading Rule
SDC	(16)	Segment Delinking Convention
SHC	(12)	Syllable Head Constraint
SHM	(65)	Syllable Head Movement
VAC	(13a)	Vocalic Association Constraint
VD	(13b)	Vowel Delinking

CHAPTER FIVE

LEXICAL LEVELS OF DERIVATION

5.0 Overview

This chapter deals with assigning tone and harmonic features to the stem and to the word. The task of assignment will introduce the various levels on which different affixes operate. As the rules are discussed, it will be shown how they operate at the various levels within the Lexicon. Tone and its assignment and rules will be examined first. Then, under the harmony section, I will consider Vowel, Vowel-Consonant and Consonant Harmony. Finally, there is a process of Nasalization affecting the nouns. This process is triggered by the addition of certain inflections to singular nouns. At the end of the chapter is a listing of all the rules and the levels in which they apply.

5.1 Tone

In Chapter Two, we saw that there are three underlying level tones in Shilluk. Then again, in Chapter Three, we saw that tone is lexical. In Chapter Four tone was shown to have morphemic status in the verbs. In 4.8, we saw that the Instrument forms of the verb have M-M tone while the Benefactive consistently has M-H. Singular and Plural nouns also have distinctive tones such that MH is only found in Singular words while HM is only found with Plural words. Thus, we can say that tone can be viewed as a morpheme.

It was not made clear, however, how tones are assigned to words. The problem of tone assignment will be discussed, and several options presented. Once a satisfactory solution has been found, the discussion will turn to tone rules as they interact with the morphology. We will then see how these rules are ordered with regard to the levels within the Lexicon.

5.1.1 Tone Association

According to Goldsmith (1976) the segmental features and the tonal features are connected by association lines. These association lines are subject to the Well-formedness Condition. The Well-formedness Condition as it relates to tone and Association Conventions are presented below.

(1) Well-formedness Condition

a. Association lines do not cross.
b. All Tone Bearing Units (TBU's) are associated to at least one tone.
c. All tones are associated to at least one TBU.

The associations themselves are carried out by means of the Associating Conventions (see, for example, van der Hulst and Smith, 1985a:17).

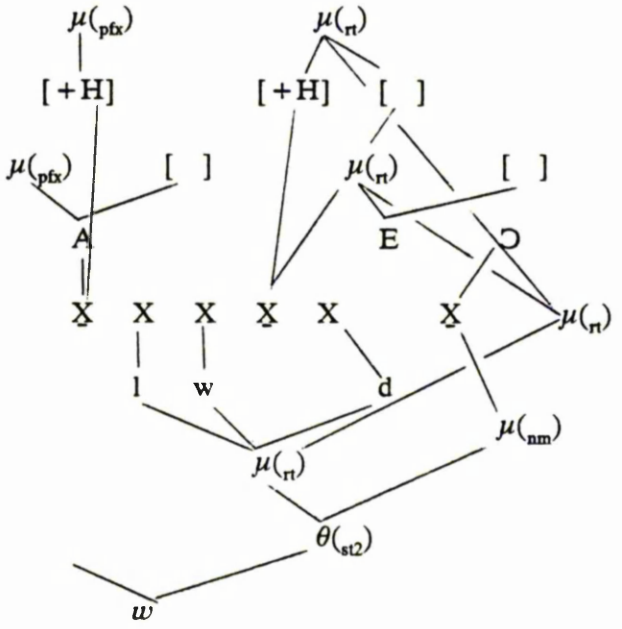
(2) Associating Conventions

a. Mapping
   Insert association lines between one tone and one TBU
   -going from left-to right/right-to-left
   -starting with the left/rightmost tone and TBU
b. Dumping
   Left over tones are associated to the nearest TBU to their right/left
c. Spreading
   Left over TBU's are associated to the nearest tone to their left/right

Limitations have also been proposed for representations. The Obligatory Contour Principle (OCP) was originally proposed by Leben (1973). It has undergone some modifications since its inception. The definition for the OCP which will be used in this thesis comes from McCarthy (1986:208) and says "at the melodic level, adjacent identical elements are prohibited ".

Using the guidelines set out above, I will try to associate the tonal morpheme tier to one-, two-, and three-syllable words in Shilluk. As has been previously discussed, the timing tier is the backbone of the autosegmental framework. All planes attach to this central point, and thus relate to each other.

The reader will recall the Underlying Representation for the word *álwé:dɔ̄* 'crab' from Chapter Three (repeated here for convenience).



The 'Root' is not a simple element. It is composed of a complex of morphemes and features; namely, the V and C tiers, [Ex] and tone. This complex functions as a unit, even though the individual elements are capable of independent extraction. In addition to the 'Root' there is a complex of morphemes which composes the prefix and yet another set for the suffix. The 'Root' and the affixes combine to yield one member of a

Singular/Plural or C-ob/C-opt stem pair. For a given member, the Vocalic Melody, [Ex] and tone are 'invariant'.

The representation shown here is the more accurate way in which to demonstrate the interrelationships among the morpheme, root, stem, word, tone, [Ex], vowel, consonant, etc. for one member of the pair, but it does not lend itself to easy interpretation when shown on two-dimensional paper. Since most of my discussion in this chapter is concerned with only one or two tiers at a time, it would add unnecessary complexity to an already intricate subject to include the required information in this appropriate and yet cumbersome representation. Therefore, I will take the liberty of substituting a simpler (if outmoded and inaccurate) representation type. This alternative representation involves the use of bracket notation. The same word *álwɛ̃:dɔ̄* 'crab' will be shown as follows:

$$[_{wd}a[_{st}[_{rt}\ lwe{:}d]_{rt}ɔ]_{st}]_{wd}$$

Tone will be associated directly to the vowel since the vowel is the Tone Bearing Unit for Shilluk.

This change in notation in no way represents a change to 'Bracketing'. The brackets and subscripts used will only be employed to indicate the morpheme boundaries in a simpler notation so that the particular topic under discussion can be highlighted.

The CVC configuration which is the basis of almost all Shilluk words will be termed the 'Root'. In its neutral or unmarked form (Sg or Coll), the 'Root' is presumed to have a zero suffix. Thus, the surface form of the 'Root' and the 'Stem' will be identical. Further discussion of 'Root' and 'Stem' is found in the next section.

5.1.2 Tone Assignment

Initially, let us assume that the tonal tier is associated to the X slot which is also associated to a syllable head and [+Voc] feature matrix. We may invoke the one-to-one mapping principle given in the Associating Conventions.

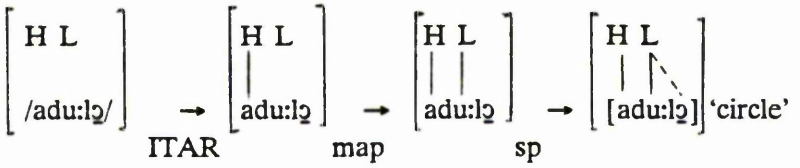
(3) Initial Tone Association Rule (ITAR)

Associate the first tone with the first tone bearing unit.

Then, tones are mapped from left to right onto the TBU's. It will be recalled that the M tone or [−H−L] is the underspecified tone. The underspecified tone is indicated by empty brackets ([]).

(4)
$$\begin{bmatrix} \text{H [] L} \\ \text{/adyeljwɔk/} \end{bmatrix} \xrightarrow[\text{ITAR}]{} \begin{bmatrix} \text{H [] L} \\ \text{adyeljwɔk} \end{bmatrix} \xrightarrow[\text{map}]{} \begin{bmatrix} \text{H [ ] L} \\ \text{[adyeljwɔk]} \end{bmatrix} \text{'butterfly'}$$

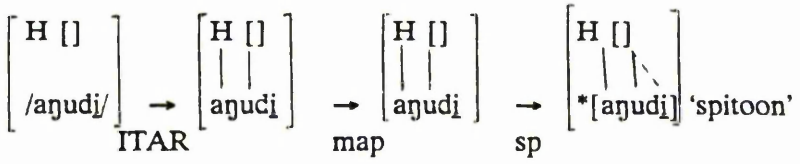
If there are more TBU's than tones, then spreading (sp) could be invoked in accordance with the AC to associate the last tone onto the remaining TBU's. This would appear to explain the tone patterns of words such as:

(5) 

While such steps will work for many words in the language, they will certainly not begin to account for all the data. Consider the tone patterns in the following words.

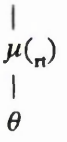
	Word	Gloss
(6)	áŋúdɪ̄	spitoon
(7)	ópā:dɔ̄	broken pot
(8)	gā́m:ɪ̄	midwives
(9)	ácùŋɔ̀	black mound termite
(10)	ákô:dɔ̀	shrew
(11)	búdɔ̀	long term illness

In these words we see that there are several ways in which to combine the tones. The device we have so far limits us in the options for combining tones unless we mark all the exceptions in the lexicon. That approach is not satisfactory. Let us look at a putative derivation in order to pinpoint the problem.

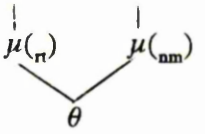
(12) 

The tone on *[áŋūdɪ̄] is incorrect since the H tone should have been on the root [ŋúd] and then the M tone should associate with the suffix. Perhaps, then, the tone should associate to the TBU in the root. Before proceeding further, then, it is necessary to define terms such as 'Root' and 'Stem'.

The CVC configuration which is the basis of almost all Shilluk words will be termed the 'Root'. In its neutral or unmarked form (Sg or Coll), the 'Root' is presumed to have no suffix. Thus, in the surface form both 'Root' and the 'Stem' will be co-extensive.

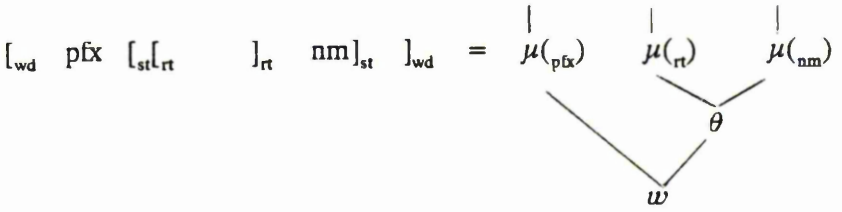
$[_{st}[_{rt}\quad]_{rt}]_{st}$ = Simple Stem = 

When the form is a morphologically marked form such as the Sglt or Pl, then there is a Number suffix (nm) which is outside the 'Root' but inside the 'Stem'. The need for this distinction will become clearer as we proceed.

$[_{st}[_{rt}\quad]_{rt}\ nm]_{st}$ = Complex Stem = 

We will assume that prefixes are outside the stem since the stem may have a distinct

meaning in its own right. The addition of a prefix would add a new and often unpredictable dimension to that meaning.



Within this framework, it is possible to set up the tone association rule to assign the tone to the root. Once the tone is mapped onto the root, let us adopt a hypothesis that spreading may occur from left to right and right to left.

(13) Root Association Rule (RAR)
Associate tones with the first vocalic X slot associated to the syllable head of root.

(14) [H[]¹ / [o[[pa:d]ɔ]]] → [H[] / opa:dɔ] (RAR) → [H[] / opa:dɔ] (sp) 'broken pot'

(15) [HL / [a[[ko:ɗ]ɔ]]] → [HL / ako:ɗɔ] (RAR) → [HL / ako:ɗɔ] (sp) 'shrew'

If, however, we apply these steps to a word such as the one previously considered in (5), we are again in trouble. Consider:

(16) [HL / [a[[dul]ɔ]]] → [HL / adulɔ] (RAR) → [HL / *[adulɔ]] (sp) 'circle'

The HL sequence has associated to the root, when only the L tone should have done this. Clearly this hypothesis was wrong. The problem is to find an analysis which can account for all the possible combinations of tones shown in examples (6) - (11).

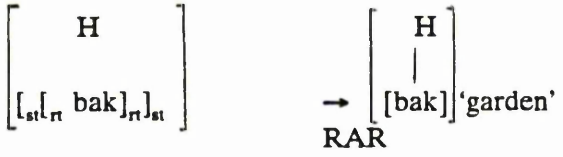
5.1.3 Assignment by Levels

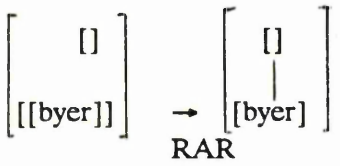
In the solution offered here, we will recognize levels in the derivation. We will look at each step to see how the tone pattern for the word is brought about. We begin with simple noun stems, and then move on to the complex stem form.

5.1.3.1 Tone in Simple Stem Words

Tone comes to be associated to the root in the Lexicon. In the case of 'neutral' forms (Sg/Coll), the tone is associated to the root vowel by the Association Conventions.

'Roots' in Shilluk have a CVC structure and simple stems have no suffix. Therefore, these words are monosyllabic.

(17) 

(18) 

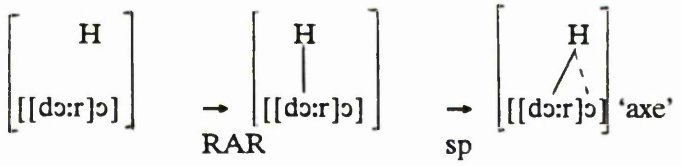
5.1.3.2 Tone in Complex Stem Words

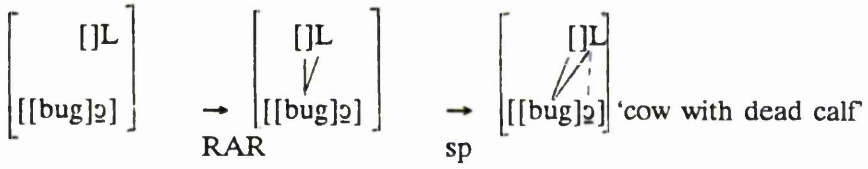
For the morphologically marked (Sglt/Pl) words, there appear to be two cases which must be dealt with. In the first case, 70% of the words have a Number marker (Nm) which is toneless. If the Nm marker has no specified tone, the root tone spreads. In the event that the root tone is assigned a sequence of two tones, the second tone is the one that spreads onto the syllable head of the Nm marker.

The Nm marker is within the stem. Since no other suffixes are allowed in the stem itself, it will be assumed that the second syllable head within the brackets is stipulated to be the Nm marker. It will be recalled that the Nm marker is in the stem but outside the root, viz:

$[_{st}[_{rt}\ ]_{rt}\ nm]_{st}$

Thus, the tone association would be as follows.

(19) 

(20) 

The tone is initially associated to the root. Since the Nm suffix is toneless, the last tone on the root spreads onto it.

In the remaining 30% of cases, the Nm suffix has a preassociated tone. This tone would be assigned in the lexicon and can be any of the three level tones (H,M,L). Since there is already a tone assigned to the suffix, no spreading occurs from the root.

(21) H L → H L 'long-term illness'
[[bud]ɔ] RAR [[bud]ɔ]

5.1.3.3 Stem External Tones

At this point, we will begin to examine the prefix tones. The prefix is considered to be outside of the stem.

$[_{wd}[_{st}[_{rt}\ ]_{rt}]_{st}]_{wd}$

In the previous analysis of examples (14) and (15), an hypothesis was put forward to the effect that the root tone spreads to the left to fill in the Prefix tone. Even apart from the patent inadequacy of that hypothesis to account for forms such as (5), statistically, this analysis is highly questionable since the Prefix tone and the initial root tones are identical only about 45% of the time. In the remaining 55% of cases, the Prefix tone is different from the root tone. Given this information, it seems reasonable to say that Prefix tone is tagged as a morpheme which is pre-associated to the appropriate X slot of the Prefix.

(22) H L → H L → H L 'black
[a[[cuŋ]ɔ]] RAR [a[cuŋɔ]] sp [acuŋɔ] mound
termite'

(23) H HL → H HL → H HL
[a[[ko:ɗ]ɔ]] RAR [a[ko:ɗɔ]] sp [ako:ɗɔ] 'shrew'

It will be recalled that the OCP requires a unitary representation of adjacent identical elements. However, in this case, we are dealing with two morphemes, namely, the Prefix and the Stem. These two morphemes function on different planes and are thus not subject to the constraints of the OCP. We will see a similar situation with regard to the [Ex] harmonic tier.

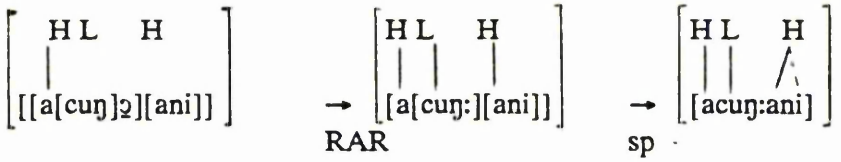
5.1.3.4 Tones on Inflections

The word, in Shilluk, is a whole unit with its own integral meaning. However, one may add inflections such as the referential determiner *-ání* or possessive determiners. When these inflections are added to the word, some radical changes occur such as stem-final consonant gemination in Sglt words as well as vowel shortening or lengthening. These changes have been discussed at length in Chapter Four. For our purposes in this chapter, these inflected forms will occur outside the word.

$[_{wd}[_{wd}\ pfx[_{st}[_{rt}\ ]_{rt}]\ nm]_{st}]_{wd}\ infl]_{wd}$

The tone assigned to *-ání* is H. In compliance with the OCP, only one H is assigned to the unit, and spreading is allowed from left to right.

(24)



In this derivation, the H is preassociated to the Pfx and the L is assigned to the root. Yet another H is assigned to the morpheme *-ani*. This H assignment is preferred since the H can spread and pre-associated tones cannot spread. We know from Chapter Four that the -ɔ is delinked because of the Dual Syllable Head Pruning Rule. The root-final consonant spreads into the slot previously linked to the vowel. Since the syllable head has lost its vocalic content, it can no longer receive a tone assignment. The only spreading that can occur in this word is within the *-ání* unit. Thus, we end up with the correct form [ácùŋ:ání] 'this black mound termite.'

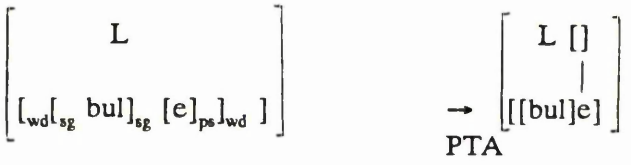
We turn now to the possession markers. Their tone is assigned by the number category of the noun to which they are attached. The possessive tone assignment is made on the basis of the *semantic* singular or plural category rather than the *morphological* singular or plural distinction. In order to clarify this point, the (±pl) is marked at the *word* level rather than at the morpheme level.

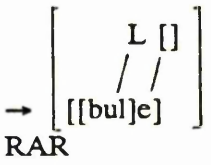
The tone on the Possession Marker (ps) of a semantically singular noun will be M while the tone of the Ps marker for 'plural' nouns will be H. We will assume, then, that the Ps markers have no inherent tone, but receive the tone assignment from the number category of the noun they 'possess'.

(25) Possessive Tone Assignment (PTA)

For the sake of simplicity in the examples, the 'bracketing' will not include *all* possible levels for monosyllabic words. A root which has no suffix and no prefix is identical to the word. Therefore, in the examples, only the noun word 'bracketing' is shown. (The reader will recall that the brackets only express a simplified representation of the morphological information.)

(26)

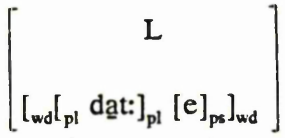


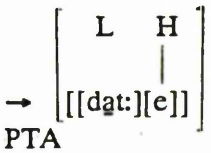


'his drum'

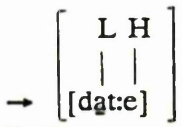
RAR

(27)





PTA



'its hooves'

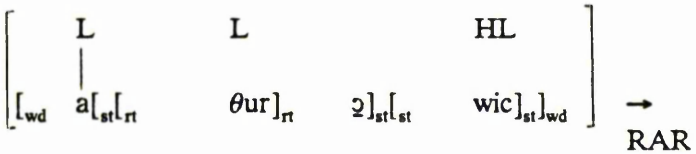
RAR

5.1.3.5 Compound Words

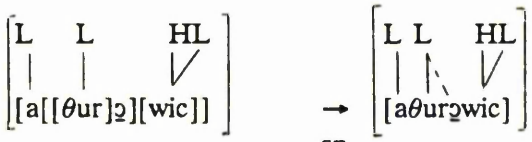
Finally, we come to tones assigned to words which have two stems. It will be recalled that genitives (especially Sglt or Pl words) have an -i possessive marker between two nouns. In the case of a compound word, this is not the case. The full forms of both words are present. True compounds are composed of separate words with no intervening marker. These compounds may be noun + noun or noun + verb. The extent of possibilities has not yet been fully investigated.

The process for assigning tone is essentially the same as with simple words in that both stems have tones assigned. Consider the word *aθurɔ̣wic* 'house of the king'. I do not know the meaning of *θurɔ̣*, but *wic* means 'head'.

(29)



→ RAR



→ sp

As shown in this example, the Prefix tone is pre-assigned while the two root tones receive their tone by the Association Conventions. The RAR links the root tones to the first vocalic X slot in the root. Then, spreading may occur, in this case, to the Nm suffix of the first root. This process gives the correct output [àθùrɔ̣̀wîc] 'house of the king.'

5.1.4 Morphotonemics

Initially in this section, the various rules for tone will be discussed. Once these rules have been identified, I will show how they apply within the level-ordering of the Lexicon.

In Chapter Four, a rule was given whereby the vowel specifying Number was

delinked. According to Leben (1978), when a vowel is deleted, the tone remains as a floating tone. A 'floating tone' is one that is 'set afloat' as a result of a deleted vowel. The tone may be reassociated to the tone-bearing unit that conditioned the delinking or loss of syllabicity (Clements and Ford, 1979). The effects of the floating tone are usually seen in the following tone. The convention given by Leben (1980:45) states that "a rule mapping a suprasegmental tone onto a segment already specified for a tonal feature does not replace this feature but instead adds another tone feature in sequence ".

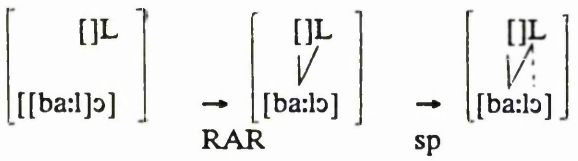
5.1.4.1 Tone Delinking with Complex Stems

Shilluk does not appear to have floating tones. The evidence suggests that when the vowel suffix is delinked, the tone is delinked as well. Consider the following.

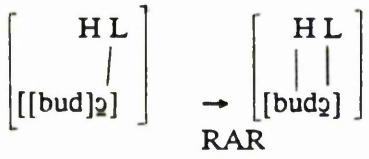
	Word	Word + Ps	Word + ání	Gloss
(30)	dɔ́:rɔ́	dɔ́:rē	dɔ́:rání	axe
(31)	bā̂:ɲɔ̰	bā̂ɲ:ē	bā̂ɲ:ání	grasshopper
(32)	bā:lɔ̀	bāl:ē	bāl:ání	scar
(33)	tùk:ì	_____	tùk:ání	rocks of mud
(34)	byɛ̰̀:lɔ́	byɛ̀l:ē	byɛ̰̀l:ání	stalk of millet
(35)	gám:ī	gám:é	gám:ání	midwives
(36)	búdɔ̰̀	búnː:ē	búnː:ání	zucchini

In these examples, we see words which receive part of their tone structure by spreading (30-33) and others which have pre-assigned tones (34-36). Let us consider the underlying structure of each case.

(32a)

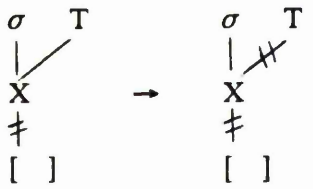


(36a)

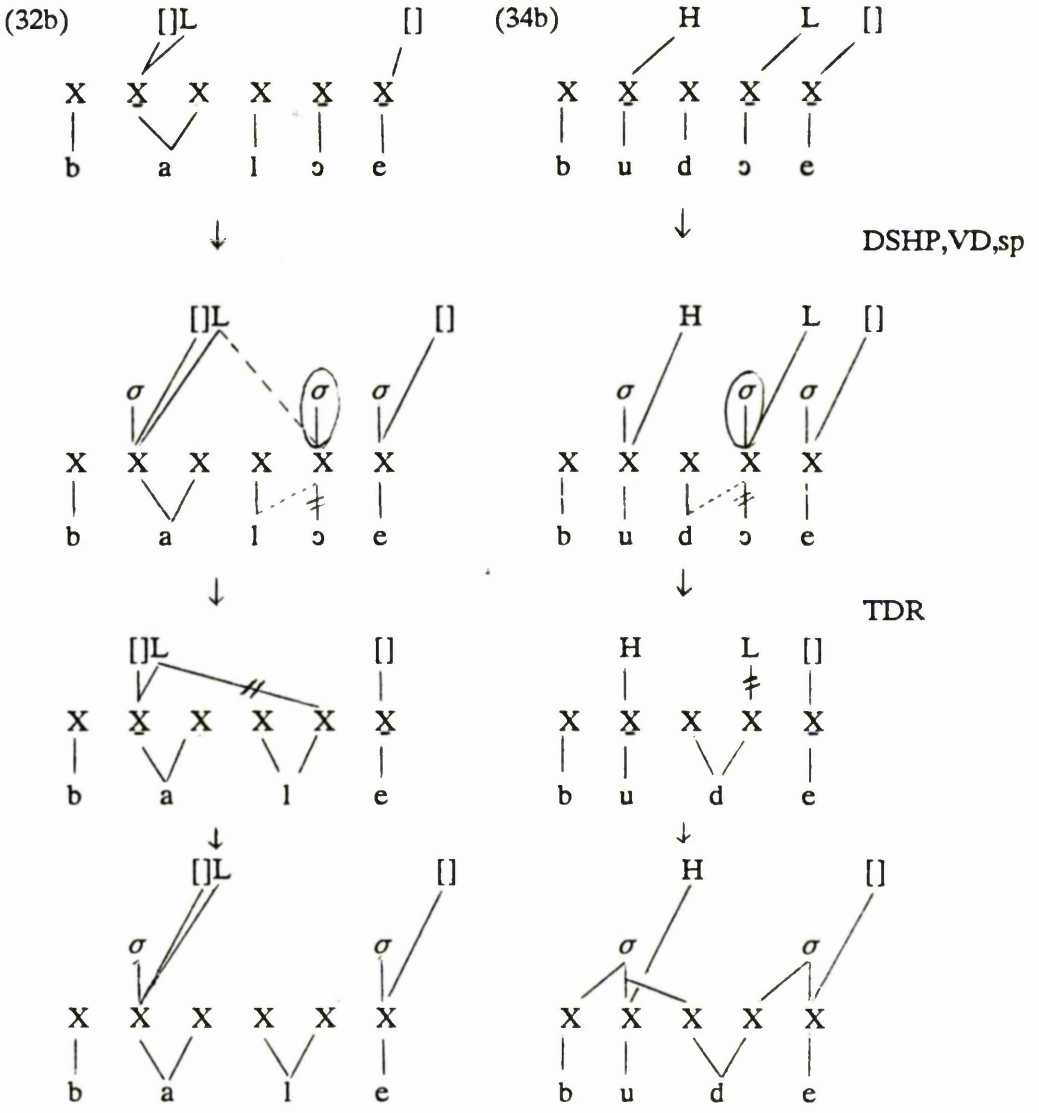


When an inflectional morpheme is added to these words, we see from the examples that the final stem tone does not appear. We know from Chapter Four that Nm suffixes are delinked when inflectional suffixes are added. The syllabicity is lost triggering the stem-final consonant to spread to the X slot to its right (see Dual Syllable Head Pruning Rule 4.36). Since only vowels bear tone in Shilluk, if a vowel is delinked from the timing tier, its tone will receive no phonetic realization.

(37) Tone Deletion Rule (TDR)



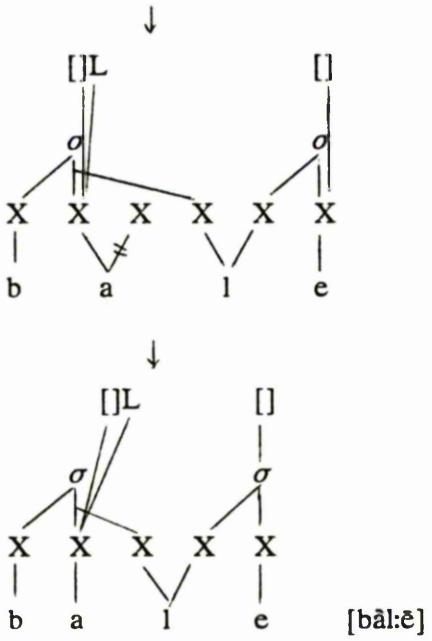
Consider the full derivation.



So, we see from these examples that when the syllable head is lost, the tone is also delinked. This principle applies to tones which are spread from the root and to tones which are pre-assigned.

Interestingly, when the vowel in the root is reduced, as in (32b), if we continue the derivation, the tone is not shortened. Both M and L occur on the short stem vowel.

(32b)



Before drawing any conclusions about this interesting tonal behavior, it is important to look at words which are morphologically simple.

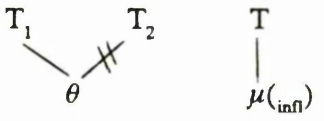
5.1.4.2 Tone Delinking with Simple Stems

We will now turn our attention to words with Simple stems. It will be recalled that having a 'simple stem' means that there is no Nm marker. Consider the following data.

	Word	Word + Ps	Word + ání	Gloss
(38)	bâŋ	bá:ŋē	bá:ŋání	servant
(39)	bǎt	bā:dē	bā:nání	arm
(40)	kwâr	kwā:rē	kwā:rání	grandchild
(41)	byĕc	byè:jē	byè:ɲání	cow with horns straight out
(42)	ámăl	ámàl:é	ámàl:ání	camels
(43)	cyə̂w	cyə̂w:é	cyə̂w:ání	porcupines

The words included here are Singular (39-41) and Collective (42-43). From the examples, we can see that the second tone of the sequence of root tones fails to appear in the inflected form. This pattern differs dramatically from the complex stems examined earlier where the contour tone is evident on the root vowel in the inflected form.

There are two ways in which to handle the retention and deletion of tone sequences. It is possible to posit a rule such that if two distinct tones are associated to a *stem*, the $T_{(n-1)}$ is delinked in the presence of an inflection. In this way, the generalization of losing the second stem tone would be captured.



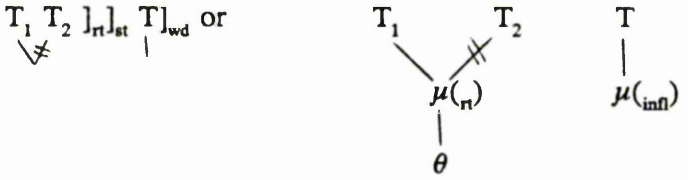
(T_2 is distinct from T_1)

In order to adequately handle the data, this analysis would probably involve positing

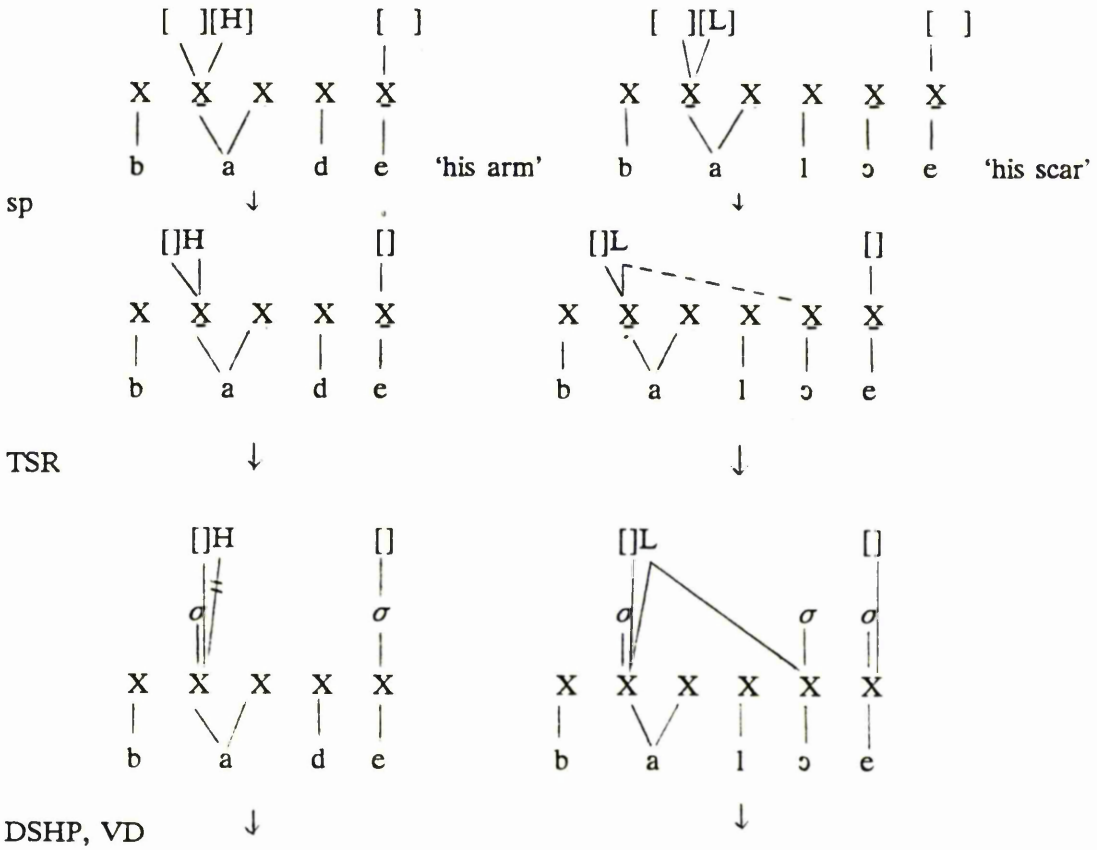
a copy rule instead of a spreading rule in order to account for the tone on the number suffix. However, if this analysis were followed, we would miss a greater generalization in Shilluk. Later in this chapter, we will see that there is a nasalization rule which applies to a complex stem, but not to a simple stem (5.3.2). The tone rule expressed below reflects this same distinction between the complex and simple stems. Thus, this second analysis seems to present a more systematic approach.

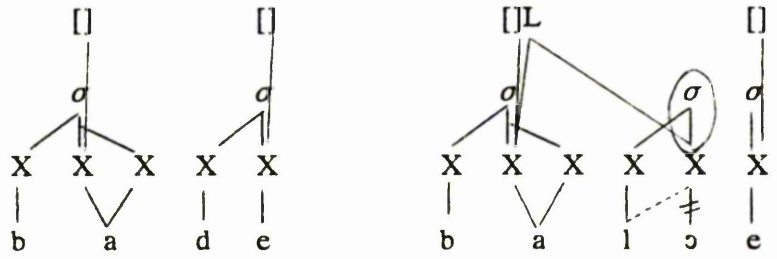
In order to describe the situation more clearly, I will state a rule to deal with the simplification of a root contour tone with a simple stem. Afterwards, a comparative derivation of the two types will be set up.

(44) Tone Simplification Rule for Unmarked Nouns (TSR)

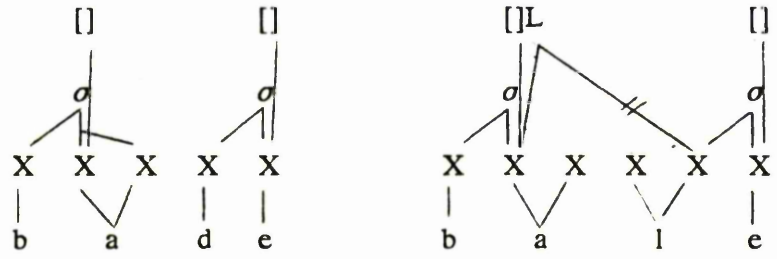


The TSR says that when a simple noun stem with a sequence of two tones is inflected, the second tone of the sequence is delinked. The derivations of both Sg and Sglt words follow.

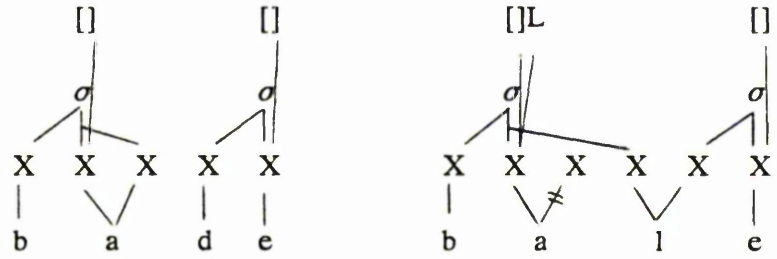




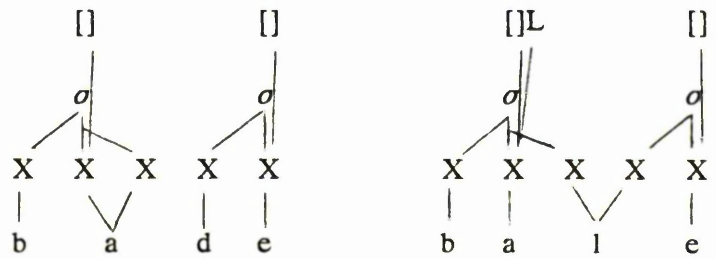
TDR ↓ ↓



CSP,Re-syll, SDC ↓ ↓



SF ↓ ↓



Within the framework of Lexical Phonology, there are at least two modules, the Lexical and the Post-lexical. Within the Lexical module, there are presumed to be various levels or strata. The number of levels and the content of each level seem to be language specific. The levels in the Lexicon contain both morphological and phonological information. The Phonological information has access to the Morphological information present at that level. With Shilluk, the lexical rules are assumed to apply in blocks such that rules which relate to the root apply first, then those relating to the stem and finally to the word. All morphological information is

retained throughout the derivation until the planes conflate just before the Post-lexical Level.

If we apply this concept to the derivation just shown for Shilluk nouns, we see that at this point there are two morphological levels. In the first of these two levels, the Tone Assignment is made to the Root. The morphology differentiates Simple stems from Complex stems. The TSR applies to Simple stems (i.e., neutral nouns), and so is enacted first. Spreading also occurs to the head of the complex stem in *ba:lɔ+e* 'his scar '.

Secondly, the DSHP rule is implemented to eliminate the Dual Syllable Heads. In the process, the vocalic content of the Nm marker is delinked. The TDR then delinks the Tone since there is no longer any vocalic content in that segment.

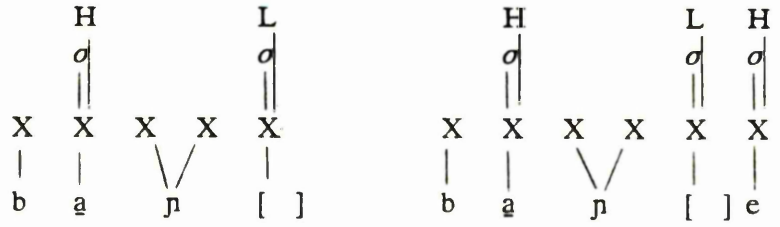
Were the DSHP rule to occur before the TA and TSR, then the syllable head of the Nm suffix would have been pruned. Both the morphologically marked and unmarked forms would then be identical, from a syllable head point of view. The result of that would be that the TSR could apply equally to both. Application of the TSR to the previously complex stems would result in incorrect forms.

5.1.4.3 Tone Delinking with Derived Plurals

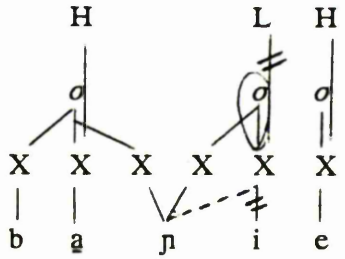
It will be recalled from Chapter Four that many plural words undergo what may be generally termed the I-Incorporation Process (IIP). This process involves both Syllable Head Movement and a change in syllable structure. With regard to the levels in the Lexicon, it seems that IIP is implemented at a later level. The ordering becomes clear when we examine the tone rules. Let us first look at the data, and then continue the analysis.

	Pl	Pl + Ps	Pl + ání	Gloss
(45)	bậ:ɲ	bán:é	bán:ání	mosquitos
(46)	bậ:c	———	bác:ání	outer layers of plants
(47)	gwɔ̰̂:k	gwɔ̰k:é	gwɔ̰k:ání	dogs
(48)	kwɔ̰:m	kwɔ̀m:é	kwɔ̀m:ání	seats for chiefs

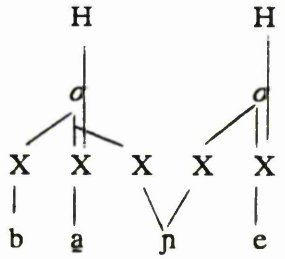
(45)



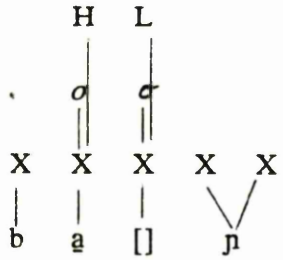
DSHP, VD, TDR ↓ ↓



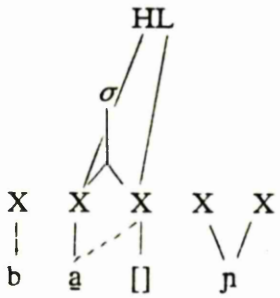
Re-syll ↓



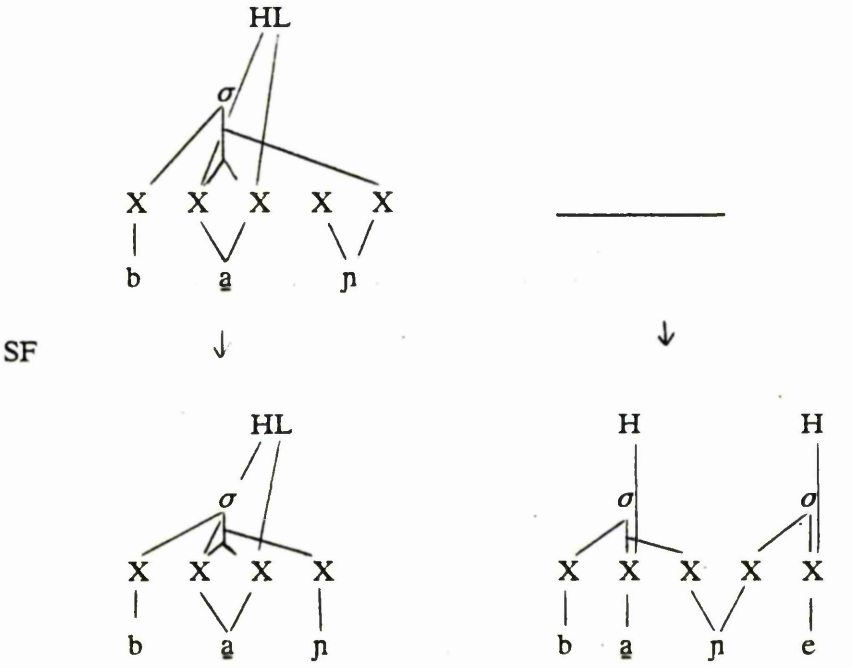
(IIP) ↓ ↓
SHM



NA, RVSR ↓



Re-syll, CSP, SDC ↓



This derivation reveals two important points. First, this ordering allows the derivation to proceed without any new rules. Only the tone rules previously set up are needed to obtain the correct surface form.

Secondly, the IIP process applies after the DSHP and TDR at Level Two. The plural marker moves into the root by the process demonstrated in Chapter Four. If the Nm suffix tone is pre-associated, then, that tone will also move into the root and a tone sequence will surface. The result, in this case, is a HL sequence on the root vowel. Evidence of this movement of tone was given in 4.6.3. The frequency of complex tones on plural words would easily be accounted for by this analysis. Underlyingly, the tones are level, but the derivation process results in a contour tone on the surface. The level ordering in the Lexicon as we now understand it looks like this:

Root Level:	TA, PTA, TSR, spreading
Stem Level:	DSHP, TDR, Syllabification, CSP, SDC
Word Level:	IIP: SHM, NA, Resyllabification including CSP and SDC

In conclusion, then, we have seen evidence to show that there are at least three levels in the Lexicon in Shilluk. At the root level, Tone Assignment is made to the root. If a noun has a simple stem, then it may be subject to the TSR, if the structural conditions are met. If it is a complex stem, then spreading may occur.

On the Stem Level, an inflected complex stem undergoes the DSHP process to conform with the Phonological Word Level Constraint which disallows two syllable heads from occuring contiguously. The TDR will come into effect when an X slot loses its [+Voc] content. The tone will be delinked from that X slot since the conditions of syllable headedness and vocalic content are no longer present. Finally, the Syllabification process and CSP will apply.

At the Word Level, the IIP processes of Syllable Head Movement and Nuclear Adjunction apply. Resyllabification will take place, including another application of CSP and SDC since syllabification is perseverative. Once the word is properly syllabified, it can leave the Lexical level and proceed to the Post-lexical module. It is assumed that the planes are conflated at the end of the final lexical Level (c.f. Cole, 1987).

Having established level-ordering in the Lexicon, and how the tone assignment fits into those levels, let us turn to another plane, that of Harmony.

5.2 Harmony Systems

Within Shilluk, there are three harmony systems at work. First we will consider the vowel harmony. Secondly, we will examine the relationship between the root vowel and the final consonant. Finally, there is evidence of some consonant harmony. We will present the data for each of these systems and show how the data may be analyzed along the same lines as the tonal system.

5.2.1 Vowel Harmony

As was stated in Chapter Two, there are two sets of vowels [±Ex]. The term Advanced Tongue Root [ATR] has frequently been used as the distinctive feature for these vowels. However, Lindau (1974, 1979) has argued persuasively for a more accurate term; namely, Expanded Pharynx [Ex]. The two sets of Shilluk vowels are listed below followed by some examples.

[−Ex]		[+Ex]	
i	o	i̱	u
e	ɔ	e̱	o̱
a		a̱	

	Word	Word + Ps	Word + ání	Gloss
(49)	àdè:rɔ̀	àdè:rē	àdè:rání	donkey
(50)	ádo̱:go̱	ádo̱:gē	ádo̱:ŋání	cow's first milk
(51)	byél	byél:é	byél:ání	millet (pl)
(52)	pì:nɔ̀	pìn:ē	pìn:ání	wasp
(53)	pi̱:no̱	pi̱n:ē	pi̱n:ání	cheek
(54)	díθwo̱l	díθwo̱lē	díθwo̱lání	black and white bull
(55)	ɲáɲâŋ	————	ɲáɲá:ŋání	type of lizard
(56)	ògwàl	ògwà:lē	ògwà:lání	frog
(57)	ògwo̱l	ògwo̱:lē	ògwo̱:lání	Sacred Ibis

An investigation of the data shows that there are some consistent points regarding the [Ex] feature. First, we notice that *all* prefixes are [−Ex]. The root, however, may be either [+Ex] or [−Ex]. Looking further, we see that the Number suffix agrees with the root with regard to its [Ex] value as in (49) and (50). The Possessive suffix (Ps), however, is always [−Ex]. It is not possible for the vowel harmony to influence the Ps suffix, nor, in fact, the -ání suffix 'this'.

Following the 'bracketing' set up in Section 5.1.2, we have the following:

$$[_{wd}[_{wd}\ pfx[_{st}[_{rt}\ ]_{rt}\ nm]_{st}]_{wd}\ infl]_{wd}$$

If we assign an [Ex] feature to the root, that feature will spread to the Nm suffix in the stem. Unlike the tones, the Nm suffix *always* agrees with the root [Ex] feature. Thus, we can formally express the [Ex] association rule as:

(13b) Root Association Rule for [Ex]
Associate [Ex] feature to the root.

We understand, of course, that [Ex] is a feature which normally associates with a vowel. We can see this process in the monosyllabic word shown below.

(51) $\begin{bmatrix} [-\text{Ex}] \\ [[\text{byEl:}]] \end{bmatrix} \xrightarrow[\text{RAR}]{} \begin{bmatrix} [-\text{Ex}] \\ | \\ [\text{byEl:}] \end{bmatrix}$ 'millet'

In this representation, an upper case letter is used to indicate the 'vowel height'. Before the addition of the [Ex] feature, it is unspecified for that feature. The uppercase letter, then, signifies that that vowel is neutral or unspecified for [Ex]. As in previous examples of this type, the phonetic symbol is also used as a shorthand for a set of Distinctive Features.

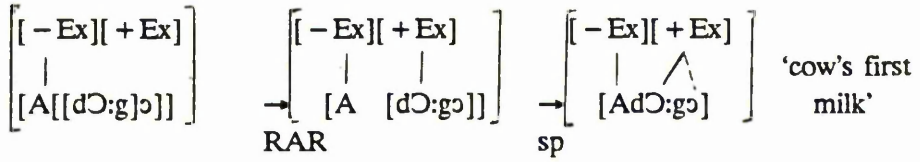
In the case of a complex stem, the RAR is applied and spreading (sp) is allowed by the Associating Conventions. Thus,

(52) $\begin{bmatrix} [-\text{Ex}] \\ [[\text{pI:n}]\text{ɔ}] \end{bmatrix} \xrightarrow[\text{RAR}]{} \begin{bmatrix} [-\text{Ex}] \\ | \\ [\text{pI:nɔ}] \end{bmatrix} \xrightarrow[\text{sp}]{} \begin{bmatrix} [-\text{Ex}] \\ \diagdown \\ [\text{pI:nɔ}] \end{bmatrix}$ 'wasp'

(53) $\begin{bmatrix} [+\text{Ex}] \\ [[\text{pI:n}]\text{ɔ}] \end{bmatrix} \xrightarrow[\text{RAR}]{} \begin{bmatrix} [+\text{Ex}] \\ | \\ [\text{pI:nɔ}] \end{bmatrix} \xrightarrow[\text{sp}]{} \begin{bmatrix} [+\text{Ex}] \\ \diagdown \\ [\text{pI:nɔ}] \end{bmatrix}$ 'cheek'

As was the case with the tones, spreading is only allowed within the stem. The only possibility, then, is left to right spreading.

At the word level, we find a Prefix. As was stated earlier, the prefix in Shilluk always has a [−Ex] value. There are two ways to deal with this fact. First, one can simply pre-assign a [−Ex] value to the prefix. This approach had to be adopted for the tones. The (100%) consistency with which the [−Ex] feature occurs on a prefix would indicate that it receives its [Ex] assignment quite independently of the root. The derivation would look like this.

(50) 

The root would receive an assignment which eventually spreads to the stem suffix. However, all of this procedure rapidly becomes cumbersome and redundant. So, we will look at a second approach to the analysis.

When there is a binary feature system, it is useful to combine the theories of markedness and underspecification (Archangeli, 1984). Within Underspecification Theory, only distinctiveness is required underlyingly. The redundant features are supplied by rule. Thus, the lexical representations of the language are streamlined.

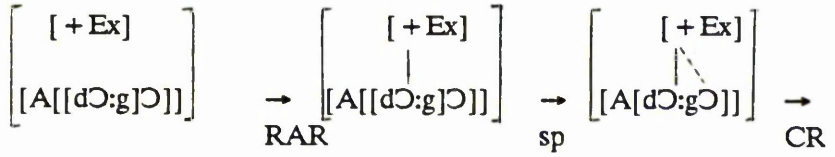
In applying underspecification to vowel harmony in Shilluk, we may say that the value [+Ex] is selected. The [−Ex] value is not stated, but is left as the unspecified value. It is filled in later by a complement rule.

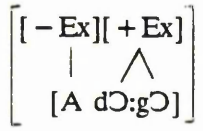
(59) Complement Rule for [Ex] (CR-[Ex])

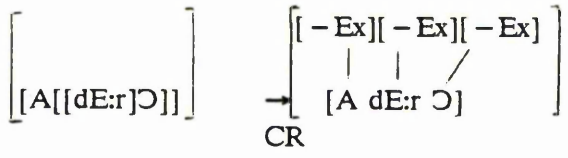
[ ] → [−Ex]

By the Complement Rule, any vowel underspecified with respect to [Ex] will receive a [−Ex] value at the end of the derivation.

The end result of this process is that only root vowels with a [+Ex] value are marked as such in the underlying representation. The [−Ex] value is filled in by rule. It seems clear, then, that the [+Ex] value is the marked value. This hypothesis agrees with findings by van der Hulst (personal communication) that the [+ATR] is the more marked value across languages. Utilizing underspecification, we may derive words in the following way.

(50b) 



(49b) 

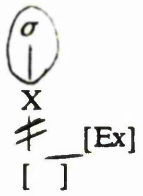
In the examples above, the [−Ex] is left unspecified. Root assignment and spreading apply as before. However, at some later point, the [−Ex] feature is assigned by the Complement Rule. It is assumed that a feature specification assigned in this way does

not spread, but that any vowel which does not have an assignment for [Ex] will receive a minus value.

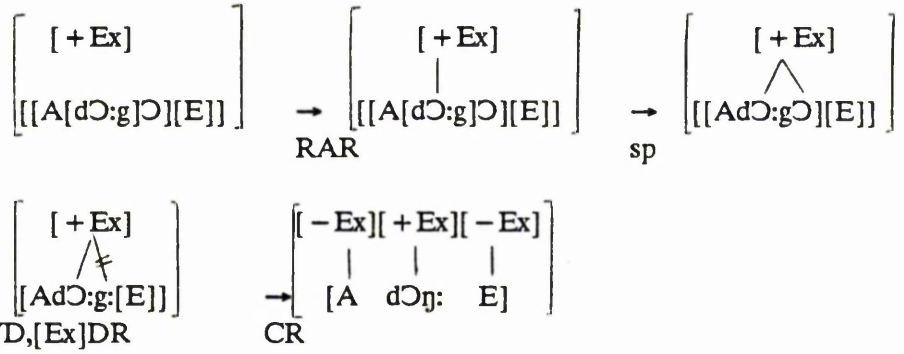
Along a similar line, it was noted in the examples (49-57) that all inflections are [−Ex]. Again, we could specify them in the representation, but that is highly redundant. Instead, they can be left underspecified, and the value will be filled in by the CR.

Before completing the derivation, one more rule is needed. The [Ex] feature normally attaches to a vowel. If the syllable head is pruned, then the vocalic tier element is disassociated along with any dependent autosegments, specifically, [Ex].

(60) [Ex] Deletion Rule ([Ex]DR)



(50c)


[+Ex]
[[A[dɔ:g]ɔ][E]]
RAR
sp
[[Adɔːgɔːgɔːgɔːgɔ][E]]
DSHP,VD,[Ex]DR
[Adɔːgːgːg

spreading apply within the stem. The CR fills in the [− Ex] value for the prefix and the simple stem [wic].

In conclusion, we find that the vowel harmony system can be easily analyzed by much the same means as the tonal system. The analysis of the vowel harmony, however, is more straightforward than for the tone since it is possible to mark only the [+ Ex] feature on the stem. All instances of [− Ex] are filled in by a Complement Rule. This analysis would lessen the already heavy memory load and presents a streamlined and accurate account of the data.

5.2.2 Stem Vowel and Final Consonant Alternation

We come now to an interesting 'sideline' within Shilluk phonology. This particular aspect of the phonology has been mentioned in the past by Kohnen and others, but no attempt has been made to offer any explanation for it. The discussion offered here is not intended to resolve the questions, but is included with the expectation that it may prompt other suggestions on ways to approach the issue. The topic at hand is the interaction between the vowel and consonant tiers within the root of Shilluk words. Consider the following sets of words.

Non-alternating words

	Word (1)	Word (2)	Gloss
(62)	gɔ̃:l	gɔ̃:l	Wild Dog/s
(63)	àcwɪ̰l	àcwɪ̰:l	brown cow/s
(64)	bɛ́*θ*	bi*θ*:i	fish spear/s
(65)	bāt́	bạ̄:t	arm/s
(66)	dút	dʊ̄:t	loin cloth/s
(67)	gwar	gwạ:r	to snatch (C-ob/C-opt)
(68)	ɗur	ɗur	to push
(69)	ma*θ*	mạ:*θ*	to drink

Alternating Words

	Word (1)	Word (2)	Gloss
(70)	lwɔ̰l	lɔ̰t	gourd/s
(71)	pāl	pật	spoon/s
(72)	kâ:l	kậ:t	cattle camp/s
(73)	bul	but	to broil (C-ob/C-opt)
(74)	ma:r	mạ:t	to love
(75)	gwi:r	gwɪ̰:t	to prepare
(76)	cwɔl	cwɔ́t:i̱	to call
(77)	tyel	tyɛ̰t:i̱	to pull
(78)	bel	bɪ̰t:i̱	to taste
(79)	*θ*al	tạ:t	to cook
(80)	byel	byɛ̰t:i̱	to carry
(81)	kɔl	kɔ̰:t	to herd away
(82)	col	cut	to pay

In the words listed above, we see there are two sets: Non-alternating and Alternating. Let us turn our attention to the root final consonants of these words. In the first set,

labelled non-alternating, we see that the final consonant of each pair of words is the same. These words represent the regular pattern of the language.

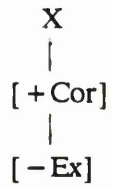
In the set of words labelled Alternating Words, we find that between the two forms there is an alternation of the root final consonant between the liquids and the voiced alveolar plosive /d/. The alternation seems to be directly related to the [Ex] value of the root vowel. The liquids are found after [−Ex] vowels while the alveolar plosive occurs after the [+Ex] vowels.

The first point which needs to be made is that these liquid/plosive alternations are irregular and should not be looked upon as representing a fully productive process. These alternations have become lexicalized and could be looked upon as historic relics.

Looking at the process itself, we see that the primary alternation is between a root final [l] and [t]. (The rules given in Chapter Two account for a syllable final /d/ becoming [t]. See 2.4.2). The second alternation is between [r] and [t]. The conditioning factor for this alternation seems to be the feature [±Ex] on the preceding root vowel.

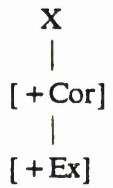
Let us suppose that consonants as well as vowels are specified as having an [Ex] feature. Unlike the vowels, however, any of which can have either [±Ex], the consonants would be specified as [−Ex] except for the /d/ which would be [+Ex] and the alternating /L/ and /R/ which would have no specification for [Ex]. Thus, the regular /l,r/ (non-alternates) would be pre-associated with [−Ex] as follows:

(83) Non-alternating /l/ and /r/



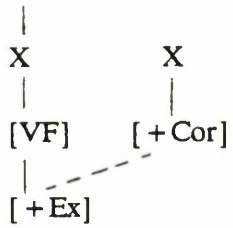
The non-alternating /d/ would be:

(84) Non-alternating /d/



The alternating consonants, then, would have the [+Cor] feature specified, but no [Ex] specified. The [Ex] value is spread or perhaps copied from the [Ex] feature associated with the root vowel.

(85) Alternating /l/ or /r/



Phonetically, then, the [+Cor, +Ex] is realized as [d] and the [+Cor, −Ex] could be [l] or [r] depending on the other features in the matrix.

Of course, all of the suggestions here are highly speculative. First of all, [Ex] has never been proposed as a consonant feature. Besides, it seems somewhat extreme to propose such a major addition to the Distinctive Feature matrix to account for these two alternating consonants, especially as they have non-alternating counterparts. In addition to these problems, [−Ex] has been suggested as the underspecified value. Yet, in this particular approach, all consonants other than /d/ and the two alternating ones would have to have a [−Ex] specification in order not to receive the [Ex] value from the root vowel. That would seem to leave open the possibility of a ternary system of [+Ex], [−Ex] and [ ]. Unfortunately, I have no solution to this dilemma and so am forced to leave it as a residual problem which needs further consideration.

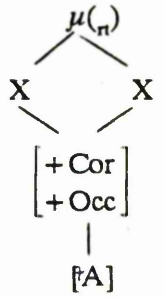
5.2.3 Consonant Harmony

Consonant harmony is limited in scope in that its domain is the root. Furthermore, it only concerns alveolar or dental stops. Below are some words.

	Dental	Gloss	Alveolar	Gloss
(86) a.	àɗúθ	stinger	b. dút	loin cloth
(87) a.	búdẓ	zucchini	b. búdẓ	long illness
(88) a.	θîn̪	small	b. tīn̪	today
(89) a.	wâθ	bull	b. wa̱t	son
(90) a.	θɔ́l	rope	b. túl	forehead
(91) a.	cyàθẓ	a walk	b. cyá:dẓ	likeness

In actual fact, we are dealing with a co-occurence constraint on consonants. Within a root, the [+Cor, +Occ] consonant may be specified for [*a*Apical].

(92) Apical Specification



Again, the minus value will be the underspecified one so that we have the following Complement Rule.

(93) Complement Rule for [A]

[ ] → [−A]

Thus, we have the following derivation.

(88)

	[+A]		[ ]	
	[TiN]	'small'	[TiN]	'today'
	↓		↓	
	[+A]		[−A]	
	∧		∧	
	[TiN]		[TiN]	
	↓		↓	
SF	[θiɲ]		[tin]	

It is not possible for the [A] to spread onto the inflection as can be seen from these examples.

	Sg	Sg + ání	Gloss
(94)	búdʒ	búɲ:ání	zucchini
(95)	wâθ	wá:ɲání	bull
(96)	θɔl	θɔ:lání	rope

We see that the -ání is unaffected by the Apical feature and remains an alveolar stop even when all other consonants in the root are dental. A derivation is shown below.

(95)

[+A]		[+A]	[+A][−A]
[[[wa:T]][aNi]]	→	[[[wa:T]][aNi]]	→ [[wa:T][aNi]]
	RAR		CR[A]

$$\rightarrow \begin{bmatrix} [+A][-A] \\ | \quad | \\ [wa{:}Nani] \end{bmatrix}$$ 'this bull'

RDNA

In (95), the [+A] feature attaches to the [+Cor] plosive in the root, but is not allowed to spread outside of that domain. Thus, the underspecified alveolar consonant in the inflection (-ání) correctly surfaces as the alveolar nasal. The [+A] feature cannot affect it. The nasalization process is a regular feature of singular words and is covered in the next section (5.3.1).

5.3 Inflected Singular Nouns

In this section, I will deal with a process of nasalization which occurs with singular words. ('Singular', here, is used in the more general sense.) The first half of this section on Inflected forms will be concerned with the addition of the Referential Determiner inflection. If a singular noun root ends in a plosive, the addition of -ání will result in the plosive becoming a nasal.

A similar process of nasalization occurs with the possessive marker. This process will be covered in the second half of the section. The difference between the Ps and the -ání is that only the Sglt nouns undergo the nasalization with the Ps.

5.3.1 Referential Determiner Inflection

When the referential determiner -ání 'this' is added to a singular word with a plosive as the root final consonant, the plosive undergoes nasalization. This nasalization process occurs with singular words, but never with plural or collective forms. Below are examples.

	Sg	Sg + ání	Pl + ání	Gloss
(97)	gwo̱k	gwo̱:ŋání	gwo̱k:ání	dog
(98)	gwɔ̱k	gwɔ̱:ŋání	gwɔ̱k:ání	work
(99)	yɛ́p	yɛ́:mání	yɛ̱p:ání	tail
(100)	àko̱c	àko̱:ɲání	àko̱c:ání	pair of shorts
(101)	àcwa̱θ	àcwa̱:n̪ání	àcwàθ:ání	guinea fowl

	Sglt	Sglt + ání	Pl + ání	Gloss
(102)	lwɛ̀:dɔ	lwén:ání	lwét:ání	finger
(103)	pwɔ̱:dɔ́	pwɔ̱n̪:ání	pwɔ̱θ:ání	field
(104)	álwɛ̀:dɔ	álwén:ání	álwét:ání	crab
(105)	búdɔ̱	búɲ:ání	būθ:ání	corgettes
(106)	ápwɔ̀:jɔ̀	ápwɔ̀ɲ:ání	ápwɔ́c:ání	rabbit
(107)	cɔ̱:gɔ̱	cɔ̱ŋ:ání	cūr:ání	bone

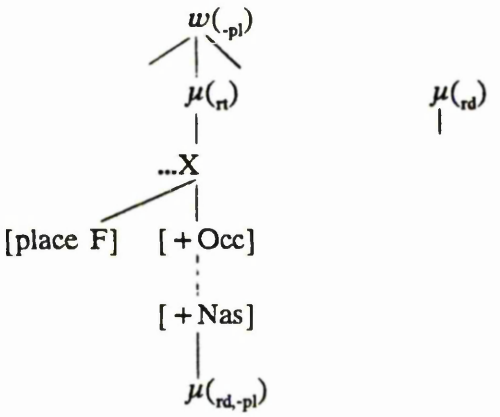
As we can see from these data, the plosives in stem final position mutate to a nasal at the same point of articulation. The gemination in the second set of words is derived by rules already set up. So, how do we account for this nasal assimilation?

Since the nasalization process only occurs with singular words, it is necessary for that morphological information to be available. Otherwise, the ordering of this step does not

seem to be crucial. The Nasalization Rule would state that if the Referential Determiner inflection is added to a semantically singular noun, a [+Nas] feature is attached to the root-final consonant.

The Nasalization Rule shown in (108) says that if that root-final consonant is a [+Occ], then the [+Nas] feature is added to the feature complex of that consonant. The phonetic result is that all Occlusives become Nasals. The difference between the Sg referential determiner (rd) -ání and the Plural -ání is the addition of the [+Nas] morpheme which indicates singularity.

(108) Referential Determiner Nasal Attachment (RDNA)



Thus, when the referential determiner is added to a semantically singular noun which also has a root-final consonant which is [+Occ], the morpheme [+Nas] attaches to that root-final consonant.

The Plural -ání has no extra element. This is clear from the fact that it may simply be added to the plural noun as an inflection.

5.3.2 Possessive Inflection

When the Ps Inflection is added to a singular noun, the result depends on whether the noun is Sglt or Sg. This distinction is somewhat reminiscent of the tone rules which were set up at the beginning of this chapter.

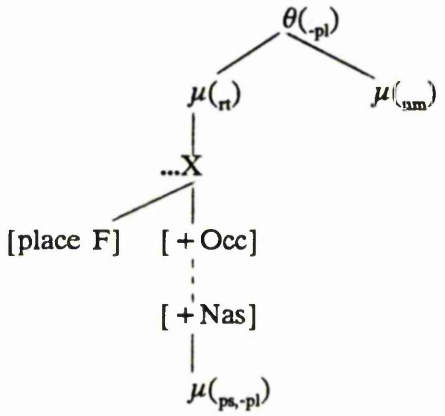
	Sg	Sg + Ps	Gloss
(97b)	gwo̱k	gwo̱:gē	(his) dog
(98b)	gwɔ̄k	gwɔ̄:gē	(his) work
(99b)	yé̱p	yé̱:bē	(his) tail
(100b)	àkɔ̱̀c	àkɔ̱̀:jē	(his) pair of shorts
(101b)	àcwā̱θ	àcwā̱:θē	(his) guinea fowl

	Sglt	Sglt + Ps	Gloss
(102b)	lwê:dɔ̄	lwén:ē	(his) finger
(103b)	pwɔ̱̀:dɔ̱́	pwɔ̱̀ṉ:ē	(his) field
(104b)	álwê:dɔ̄	álwén:ē	(his) crab
(105b)	búdɔ̱̀	búṉ:ē	(his) corgette

(106b)	ápwɔ̀:jɔ̀	ápwɔ̀ɲ:ɛ̄	(his) rabbit
(107b)	cə̀:gə̀	cə̀ŋ:ɛ̄	(his) bone

In the examples given above (97-101) we notice that the Sg + Ps forms have no nasalization process. However, in the Sglt forms (102-107) there is a nasal process at work. The simplest way to handle this distinction is to say that Possessive Nasal Attachment only occurs with singular nouns with complex stems. This addition of the nasal feature would have to be ordered early on before the DSHP rule so that the presence of the Sglt suffix -ɔ + Ps could trigger the association of the [+Nas] morpheme indicating 'Singularity'.

(109) Possessive Nasal Attachment (PNA)



The PNA rule says that semantically singular words with complex stems (i.e., Sglt words) which also have a [+Occ] root-final consonant, will receive a [+Nas] morpheme attachment when a possessive morpheme is added to the word.

5.4 Summary of Levels and Rules

In this section, I will attempt to summarize the various rules which have been posited in this chapter within the Levels in which they apply. Of necessity, some rules will have been developed in other chapters.

At the beginning of the derivation, the Root Assignments for Tone, [Ex], [A] and Possessive Tone Assignment are made.

(13) Root Association Rule (RAR) (Generalized)

Associate the feature with the first feature bearing unit in the root.

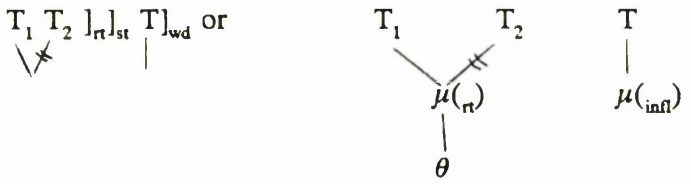
The Obligatory Contour Principle applies within the limit of the root to each of these features. Thus, spreading may apply by the Associating Conventions from the root to the stem.

We saw evidence that some tones are assigned according to the grammatical category. Specifically, the tone on the Possessive Marker is assigned according to the morphological singular or plural category of the noun to which it is attached. The related rule is shown below.

(25) Possessive Tone Assignment (PTA)

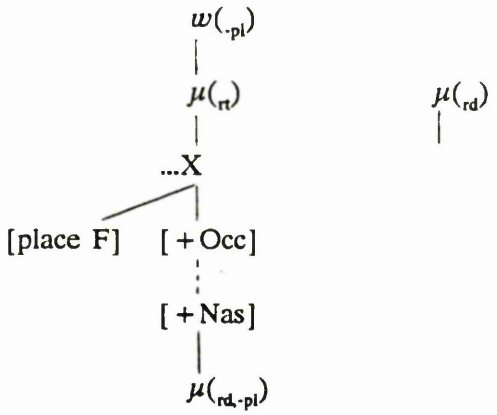
The Tone Simplification Rule also applies here.

(44) Tone Simplification Rule for Unmarked Nouns (TSR)

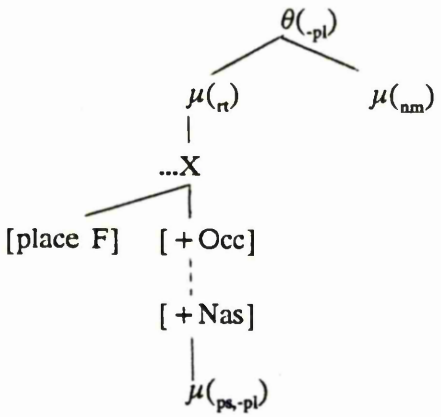


While the information regarding 'singular noun' is still available, the [Nas] morphemes indicating 'Singularity' must be included.

(108) Referential Determiner Nasal Attachment (RDNA)

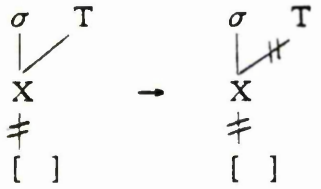


(109) Possessive Nasal Attachment (PNA)

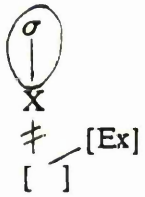


At the Stem Level, the DSHP (4.36), CSR (4.15), SDC (4.16) apply. The CSR and SDC will reapply at all levels in order to correctly re-syllabify the string during the derivation. There are also several rules which deal with the deletion or delinking of features. These are listed below.

(37) Tone Deletion Rule (TDR)



(60) [Ex] Deletion Rule ([Ex]DR)



At the Word Level, the I-Incorporation Process applies. The rules included here are Syllable Head Movement, Nuclear Adjunction as well as the RVSR Rule (4.67).

Finally, I will list the Complement Rules used to fill in the minus values in the appropriate matrices.

(59) Complement Rule for [Ex] (CR-[Ex])

[ ] → [−Ex]

(93) Complement Rule for [A] (CR[A])

[ ] → [−A]

ABBREVIATIONS

([Ex]DR)	(60)	[Ex] Deletion Rule
(PNA)	(109)	Possessive Nasal Attachment
(PTA)	(25)	Possessive Tone Assignment
(RAR)	(13)	Root Association Rule
(RDNA)	(108)	Referential Determiner Nasal Attachment
(TSR)	(44)	Tone Simplification Rule
(TDR)	(37)	Tone Deletion Rule

FOOTNOTE

[1] In example (14), it should be noted that the underspecified tone is allocated in the same way as a H or L tone. For the moment, spreading is assumed to account for association of tone to the stem suffix since that is the process for H and L tones. However, underspecified features are not actually allowed to spread. At the end of the derivation, all units without an assigned H or L tone will be assigned a M tone [−H−L].

CHAPTER SIX

SUMMARY AND CONCLUSIONS

6.1 Advantages of Generative Phonology

The Non-linear Generative approach combined with Lexical Phonology and Underspecification Theory seem to offer the simplest and most economical analysis of the language. Distinctive Features are assumed to have their own tier or plane.

Lexical Phonology allows rules to be ordered in such a way so as to include morphological information. There are three blocks of rules which apply within the Shilluk Lexicon. Rules which do not need morphological information in their structural description and apply consistently are found in the Postlexical module.

Underspecification Theory enables us to simplify the amount of 'learned' information since only 'distinctiveness' is specified. All other values are filled in by Default Rules.

These three theories have combined to supply an adequate account of Shilluk. There is only one major point at which the Shilluk data departs from the 'expected'. The point in question does not contest any of these phonological theories, but does question a general assumption made about underlying representations.

6.2 Independent Underlying Representations

One of the most interesting aspects of Shilluk phonology is found in the underlying representations of the nouns and Transitive verbs. When two forms of a word, such as singular and plural, utilize variants of a single morpheme, then it should be possible to give a unique representation to that morpheme. Rules are used to convert a single UR into its surface alternates (Schane, 1973:74-5). Thus, the singular and plural forms should be derived from a common source, except for words whose forms are suppletive.

It is with regard to this point that Shilluk seems to part company with linguistic expectation. It is not possible to derive Shilluk singulars and plurals or Transitive verb forms from a single UR. In Chapter Three, numerous 'Points of Variability' (Section 3.2.2) are discussed. There is unpredictable variation in 1) the initial root consonant (Cw or Cy alternates with C), 2) the root-final consonant (/l/ or /r/ sometimes alternates with /d/), and 3) the root vowel. With regard to the root vowel, it is impossible to predict 1) the feature [Ex], 2) the 'vowel height' (E~I, O~Ɔ, E~A) or 3) the tone. Further discussion in Chapter Four shows that structurally too there may be a difference between singular and plural at the UR level. The plural forms have root-final geminate consonants whereas the singular words have only a single root-final consonant.

There is a distinction drawn in Shilluk between words which are 'related' and those which are suppletive. [gìn] and [jáṃːɪ̰] 'thing/s' are suppletive while [waːl] and [wa̰ːt] 'to boil' are related. The deciding factors in determining the relationship seem to rest on the words having the same initial consonant and a predictable (within certain limits) final consonant in the root. In neither case are both of the forms derivable from a common or unique UR. Thus, two forms for each 'morpheme' must be learned by the language learner.

6.3 Implications for Language Learning

This claim for independent UR's has obvious implications for linguistics, particularly in the area of child language acquisition. Since all children are assumed to learn language at the same rate, there would seem to be similar processes at work for all language learners. If Shilluk children must memorize the singular and plural of nouns and the C-ob and C-opt forms of every transitive verb without the benefit of a common UR and derivational rules, then it would imply that children learning other languages *may* be memorizing more than had been thought. If so, the memory load and the capacity for learning this amount of material is far greater than has previously been assumed.

At this point, it would be difficult to draw further conclusions. More research needs to be carried out with regard to child language acquisition among Shilluk children.[1]

6.4 Syllable Structure

Syllable structure is another area of study to which Shilluk data provides some valuable insights. It is suggested in this thesis that there are two syllable structures available for Shilluk roots. These two structures account for words whose root vowel is either Invariably Short (IS), Invariably Long (IL) or Alternatingly Short and Long (ASL). Evidence for this claim is in Chapter Four.

Syllable structure rules account for the alternation of vowel length and the gemination of some root-final consonants. One of the most interesting aspects of Shilluk syllable structure is found in the I-Incorporation Process described in 4.6.3. The -i suffix is, on occasion, moved into the root vowel of the word. The result is a change of syllable structure in that form to an IL vowel. However, the other forms of that word typically have ASL vowels in the root. Through this process, we may deduce that a concatenative language is becoming a non-concatenative one.

Syllable structure rules apply perseveratively in Shilluk. Rules are sensitive to syllable structure such that whenever a structure is altered, the result must comply with syllable structure constraints. If an element cannot be syllabified, then that element cannot appear on the surface. Thus, syllable structure accounts simply and economically for variations of forms that would otherwise require numerous *ad hoc* rules.

6.5 Composition of Shilluk Words

In Shilluk words, the basic element is the 'root'. The root is normally composed of the pattern CVC. The 'stem' would be made up of the root plus a number suffix. Any prefix attached to the stem is considered to be on a separate level. This structure is a phonological 'word'. Other suffixes may be added as inflections to a 'word'. Most phonological rules may only apply within the stem. The principle exception to that statement is syllable structure. Syllable structure rules apply perseveratively at all levels of derivation.

6.6 Features and Feature Assignments

The assignment of tone to the word is discussed in Chapter Five. It was found that tone is assigned to the root and the Well-formedness Conditions (WFC) *may* apply as far as the stem. However, prefixes and inflectional suffixes have their own tone which are regarded as underived, i.e., preassociated.

Similarly, the [Ex] feature is assigned to the root and spreads by the WFC to the stem. All prefixes and inflectional suffixes receive a [− Ex] assignment.

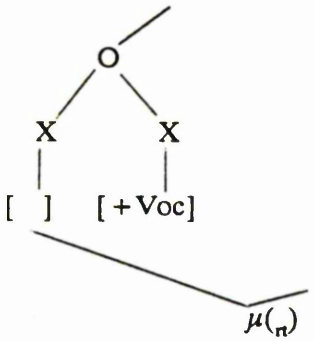
In Chapter Two, it is shown that there are three level tones in Shilluk. The M tone cannot be accounted for by means of assimilation, dissimilation, polarization, upstep or downstep. Furthermore, all possible combinations of these three tones are found in sequences of tones (with the exception of LM). It is assumed, then, that the M tone is a distinctive level tone, but may be analyzed as the unmarked or underspecified tone. 'H' means 'go up one step' and 'L' means 'go down one step' (following Hyman, 1986).

6.7 The Lexicon

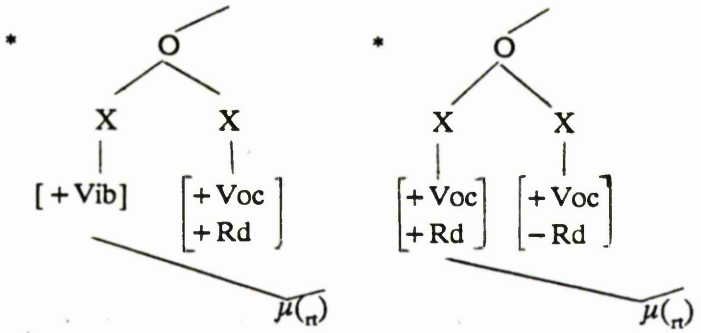
Within the Lexicon, there are three levels or blocks of rules. Each level refers to a morphological level, i.e., root, stem or word. The rules for each level are listed below.

Co-occurence Condition and Constraints

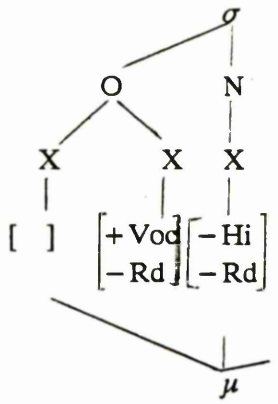
(2.78) Initial Consonant Sequence (ICS)



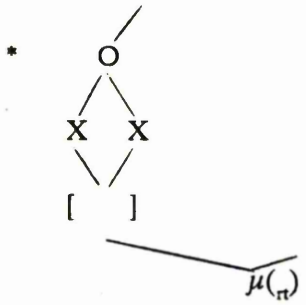
(2.79) Initial Consonant Sequence Constraint (ICSC)



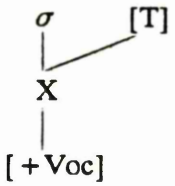
(2.80) Glide and Vowel Constraint (GVC)



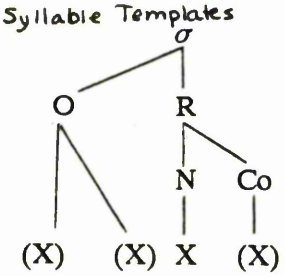
(2.90) Initial Geminate Consonant Sequence Constraint (IGCSC)



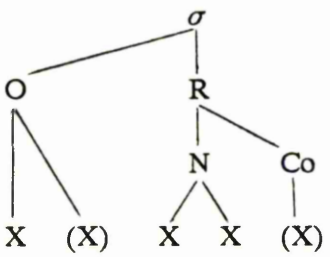
(3.185) Tone Association



(4.10a) Syllable Templates

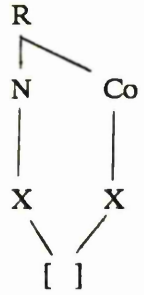


(4.10b)

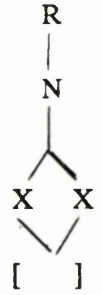


(4.12) Syllable Head Constraint (SHC)

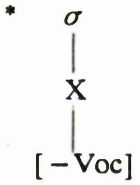
(10a)



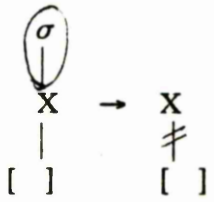
(10b)



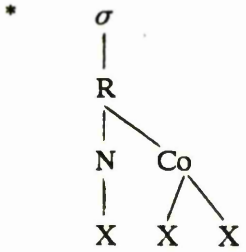
(4.13a) Vocalic Association Constraint (VAC)



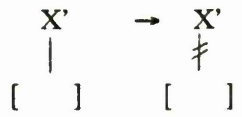
(4.13b) Vocalic Delinking (VD)



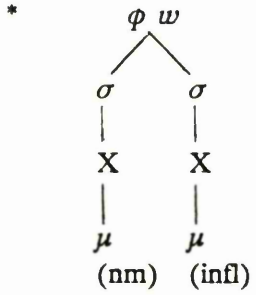
(4.14) Branching Coda Constraint (BCC)



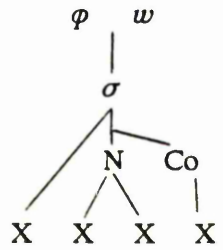
(4.16) Segment Delinking Convention



(4.35) Phonological Word Level Constraint (PWL)



(4.46) Marked Vowel Coda Constraint



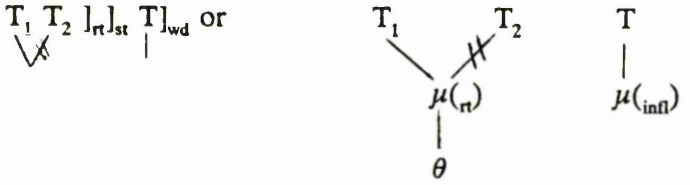
(5.13) Root Association Rule (RAR) (Generalized)

Associate the feature with the first feature bearing unit in the root.

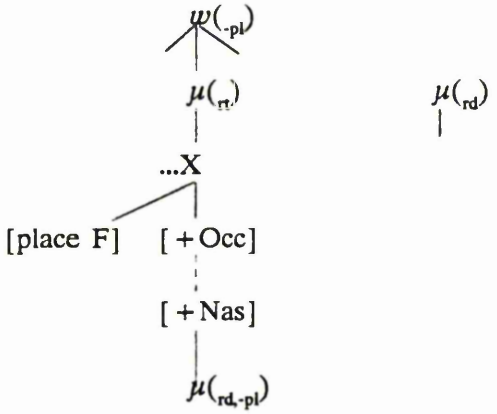
Root Level:

(5.25) Possessive Tone Assignment (PTA)

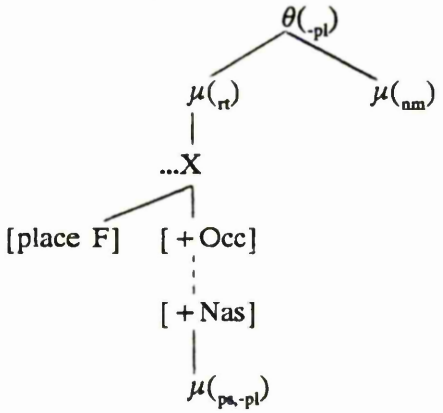
(5.44) Tone Simplification Rule for Unmarked Nouns (TSR)



(5.108) Referential Determiner Nasal Attachment (RDNA)

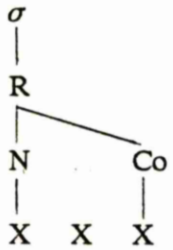


(5.109) Possessive Nasal Attachment (PNA)

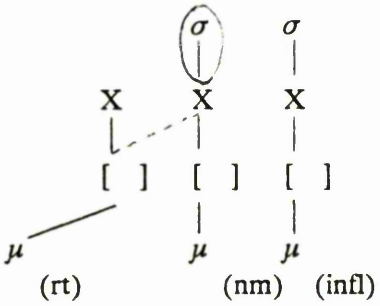


Stem Level:

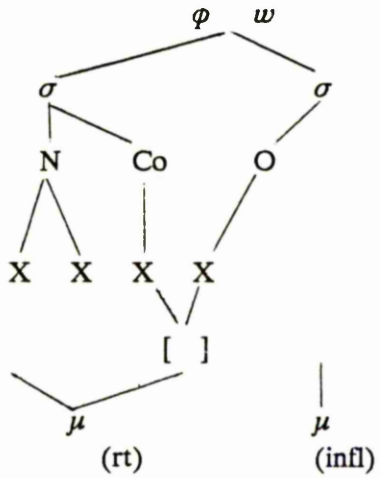
(4.15) Coda Syllabification (Rightmost Selection) Principle (CSP)



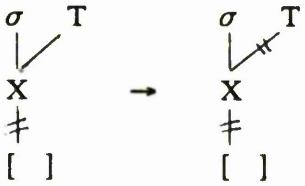
(4.36) Dual Syllable Head Pruning Rule (DSHP)



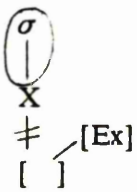
(4.47) Marked Vowel Coda Delinking (MVCD)



(5.37) Tone Deletion Rule (TDR)

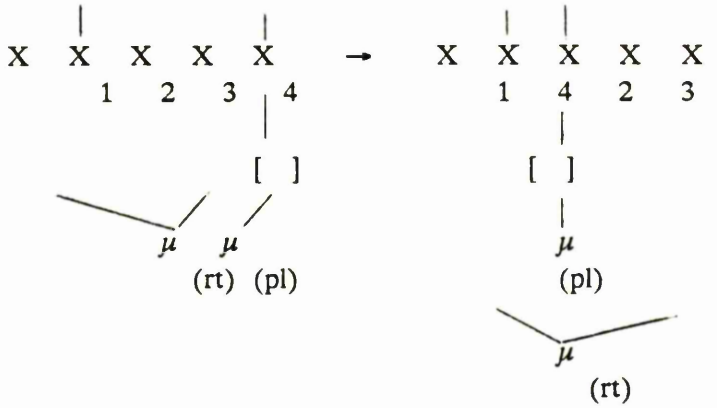


(5.60) [Ex] Deletion Rule ([Ex]DR)

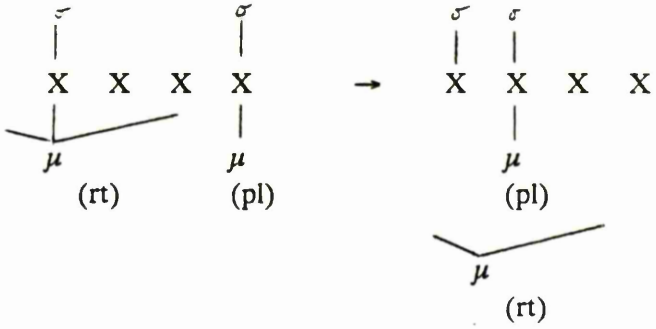


Word Level:

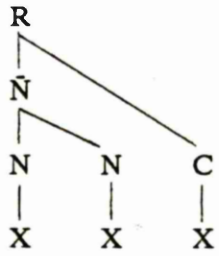
(4.64) (Optional) Plural Metathesis Rule (PMR)



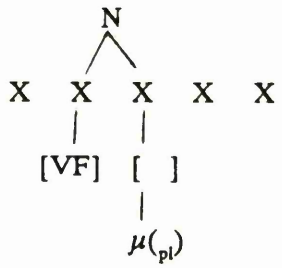
(4.65) Syllable Head Movement (SHM)



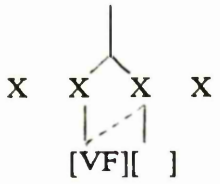
(4.66) Nuclear Adjunction (NA)



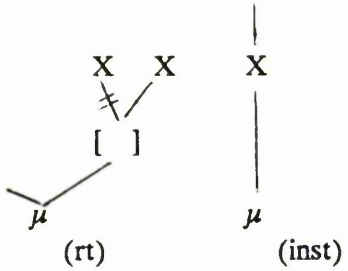
This results in a complex nucleus.



(4.67) Root Vowel Spreading Rule (RVSR)



(4.83) Root-Final Consonant Delinking Rule (RFCDR)



Complement Rules apply as late as possible. They are listed below.

(5.59) Complement Rule for [Ex] (CR – [Ex])

$[\ ] \rightarrow [-\text{Ex}]$

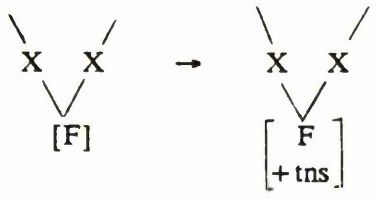
(5.93) Complement Rule for [A]

$[\ ] \rightarrow [-\text{A}]$

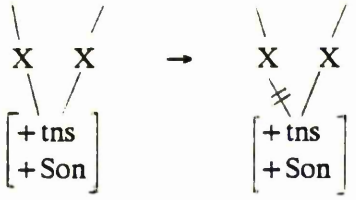
6.8 Postlexical Level

After the Lexical Level, the Postlexical Rules are applied. Within the Postlexical level, a new feature is introduced as a Phonetic feature, namely, [Tense]. This feature is explained in Chapter Two. At present, the feature [tns] is the result of an underlying structure; a geminate consonant. It may be, however, that in the future, this feature will become a Distinctive Feature in its own right. The feature [tns] accounts for the fortis quality of the [+Son] consonants and the devoicing and aspiration of the [–Son] consonants.

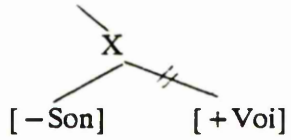
(2.81) Tensing Rule (TR)



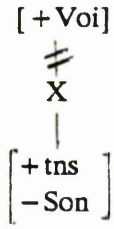
(2.82) Phonetic Shortening Rule (PSR)



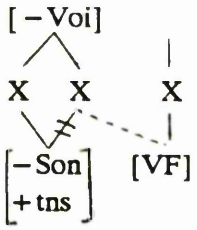
(2.85) Syllable-Final Devoicing (SFD)



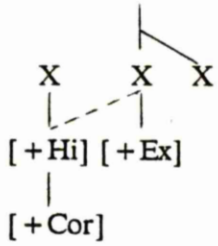
(2.89) Tense-Voicing Rule (TVR)



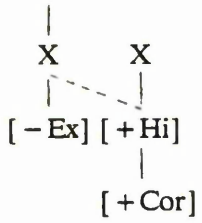
(2.91) Intervocalic Aspiration Rule (IAR)



(2.95) Diphthong High Spreading Rule (DHSR)



(2.96) Off-glide High Spreading Rule (OHSR)



6.9 Further Research

At the beginning of Chapter Three, a synopsis of some main aspects of the syntax is given. There are many areas within the syntax which need further investigation. I will mention a few specific possibilities.

The verbal system of Shilluk would provide a very fertile area for research. The C-ob/C-opt system needs considerable study. Additionally, it should be noted that with auxillary verbs, the ASL and IS verbs use one form while the IL words use the other (C-ob/C-opt) form.

Topicalization and focalization as it relates to the surface word order would also be a fascinating subject for study.

Another area of possible investigation is the use of grammatical tone, particularly as it relates to the verbs. My research has concentrated primarly on tone in nouns.

Child language acquisition has been mentioned already as a needed area of research.

Previous works on Shilluk have concentrated on providing a description of the language. Several orthographies for the Shilluk language have been developed on the basis of these studies. However, for most Shilluks, the results have been unsatisfactory.

In an attempt to develop a more acceptable orthography for the Shilluk language, it became necessary to discover a system that would explain the apparent 'inconsistencies' of the language. One of the most significant insights resulting from this thesis, from an orthographic point of view, is the inclusion of root-final geminate consonants.

I have begun work on this area of orthography already. It is hoped that the orthography to be proposed on the basis of the facts presented will represent more closely the perception that Shilluk people have of their language. Their response to that orthography will ultimately decide the accuracy of the conclusions presented here. If Shilluks find it workable, so much the better. If not, there will be significantly more areas of Shilluk phonology in need of investigation.

FOOTNOTE

[1] The one child I have been able to observe personally is being raised in London, England in a tri-lingual situation. At 18 months of age, she has begun using one word utterances in Shilluk. This behavior seems to be well within normal developmental limits.

REFERENCES

Anderson, S. R.: 1978, 'Tone Features', in V. Fromkin (ed.) *Tone: A Linguistic Survey,* 133-76, Academic Press, New York.

Anonymous: 1935, *Dholuo Grammar,* English Press Ltd., Nairobi. (Author-a member of St. Joseph's Society, Mill Hill, London).

Archangeli, D.: 1984, *Underspecification in Yawelmani Phonology and Morphology,* Ph.D. dissertation, MIT, Cambridge, Mass.

Barahmen, M., S. Helsztyński and J. Kryżanowski (eds.): 1971, *Studies in Language and Literature in Honour of Margaret Schlauch, Russell and Russell, New York.*

Belletti, A., L. Brandi, L. Rizzi (eds.): 1981, *Theory of Markedness in Generative Grammar,* (Proceedings of the GLOW Conference, 1979) Scuola Normale Superiore di Pisa, Pisa.

Boger, K., H. van der Hulst, and M. Mous (eds.): 1986, *The Phonological Representation of Suprasegmentals,* Foris, Dordrecht.

Booij, G. and J. Rubach: 1987, 'Postcyclic Versus Postlexical Rules in Lexical Phonology,' *Linguistic Inquiry* **18**, 1-44.

Chomsky, N. and M. Halle: 1968, *The Sound Pattern of English,* Harper and Row, New York.

Clements, G. N.: 1985, 'The Geometry of Phonological Features,' in C.J. Ewen and J.M. Anderson (eds.), *Phonology Yearbook* **2**, 223-50, Cambridge University Press, Cambridge.

_____ and K. C. Ford: 1979, 'Kikuyu Tone Shift and Its Synchronic Consequences.' *Linguistic Inquiry* **10**, 179-210.

_____ : 1981, 'On the Phonological Status of Downstep in Kikuyu,' in D.L. Goyvaerts (ed.) *Phonology in the 1980's*, 309-58, E. Story-Scientia, Ghent/Belgium.

Clements, G. and J. Goldsmith (eds.): 1984, *Autosegmental Studies in Bantu Tone*, Foris, Dordrecht.

Clements, G. and J. Keyser: 1983, *CV Phonology*, MIT Press, Cambridge, Mass.

Clements, G. and E. Sezer: 1982, 'Vowel and Consonant Disharmony in Turkish,' in H. van der Hulst and N. Smith (eds.) *SPR* **2**, 213-56, Foris, Dordrecht.

Coates, H.: 1985, 'Otuho Phonology and Orthography,' in M.R. Wise and R. Watson (eds.), *Occasional Papers in the Study of Sudanese Languages*, **4**, 86-118, Summer Institute of Linguistics, Juba, Sudan.

Cole, J.S.: 1987, *Planar Phonology and Morphology*, Ph.D. dissertation, MIT, Cambridge, Mass.

Crystal, D.: 1985, *A Dictionary of Linguistics and Phonetics*, Basil Blackwell Ltd., Oxford.

Dimmendaal, G.: 1983, *The Turkana Language*, African Languages and Linguistics **2**, Foris, Dordrecht.

Ewen, C.J. and J.M. Anderson (eds.): 1985, *Phonology Yearbook* **2**, Cambridge University Press, Cambridge.

Fishman, J.A. (ed.): 1986, *The Fergusonian Impact* **1**: from Phonology to Society, Mouton de Gruyter, Berlin.

Fromkin, V. A. (ed.): 1978, *Tone: A Linguistic Survey*, Academic Press, New York.

Goldsmith, J. A.: 1976, *Autosegmental Phonology*, Ph.D. dissertation, MIT, Published by Garland Press, New York (1979).

Goyvaerts, D.L.(ed.): 1981, *Phonology in the 1980's*, E. Story-Scientia, Ghent/Belgium.

Haraguchi, S.: 1977, *The Tone Pattern of Japanese: An Autosegmental Theory of Tonology*, Hinode Printing Co., Tôkyô.

_____: 1987, 'On Generalization in Segmental Phonology' In XIV International Congress of Linguists (CIPL),Berlin 10-15 August, 1987, Organized under the auspices of CIPL, Comite International Permanent des Linguistes, Berlin.

Hayward, R.J.: 1986, 'The High Central Vowel in Amharic: New Approaches to an Old Problem,' in Joshua A. Fishman (ed.), *The Fergusonian Impact* **1**: From Phonology to Society, Mouton de Gruyter, Berlin.

Heasty, J.A.: 1937, *English-Shilluk, Shilluk-English Dictionary*, The American Mission, Doleib Hill, Sudan (Reprinted 1974).

Hermans, B.: 1985, 'The Relation between Aspiration and Preaspiration in Icelandic,' in H. van der Hulst and N. Smith (eds.) *Advances in Nonlinear Phonology*, 237-66, Foris, Dordrecht.

Hock, H.H.: 1986, 'Compensatory Lengthening: In Defense of the Concept 'Mora', *Folia Linguistica* Vol XX/3-4.

Hyman, L.: 1979, 'A Reanalysis of Tonal Downstep,' *Journal of African Languages and Linguistics* **1**, 9-29.

_____: 1985a, *A Theory of Phonological Weight*, Foris, Dordrecht.

_____: 1985b, 'Word Domains and Downstep in Bamileke-Dschang,' in C.J. Ewen and J.M. Anderson (eds.), *Phonology Yearbook* **2**, 47-84, Cambridge University Press, Cambridge.

_____: 1986, 'The Representation of Multiple Tone Heights,' in K. Bogers, H. van der Hulst and M. Mous (eds.), Phonological Representation of Suprasegmentals, 109-52, Foris, Dordrecht.

Jacobson, L.: 1980, 'Voice Quality Harmony in Western Nilotic Languages,' in R.M. Vago (ed.), *Issues in Vowel Harmony*, Proceedings of the Cuny Linguistics Conference on Vowel Harmony, 14th May, 1977. 185-200, John Benjamins B.V., Amsterdam.

Kahn, D.: 1976, *Syllable-based Generalizations in English Phonology,* Ph.D. dissertation, MIT, Cambridge. Published by Garland Press, New York, 1980.

Kaisse, E.M. and P.A. Shaw: 1985, 'On the Theory of Lexical Phonology,' in C.J. Ewen and J.M. Anderson (eds.) *Phonology Yearbook* **2**, 1-30, Cambridge University Press, Cambridge.

Kaye, J.D.: 1982, 'Harmony Processes in Vata' in H. van der Hulst and N. Smith (eds.), *SPR* **2**, 385-452, Foris, Dordrecht.

_____ and J. Lowenstamm: 1981, 'Syllable Structure and Markedness Theory,' in A. Belletti, L. Brandi, L. Rizzi (eds.), *Theory of Markedness in Generative Grammar*, (Proceedings of the GLOW Conference. 1979) 469-79, Scuola Normale Superiore di Pisa, Pisa

Kiparsky, P.: 1982, 'From Cyclic Phonology to Lexical Phonology,' in H. van der Hulst and N. Smith (eds.) *SPR* **1**, 131-76, Foris, Dordrecht.

Kisseberth, C.: 1984, 'Digo Tonology' in G.N. Clements and J. Goldsmith (eds.) *Autosegmental Studies in Bantu Tone*, 105-182, Foris, Dordrecht.

Kohnen, B.: 1933, *Shilluk Grammar*, The Nigrizia School Press, Verona.

Kurłowicz, J.: 1971, 'A Problem of Germanic Alliteration' in M. Barahmen, S. Helsztyński and J. Kryźanowski (eds.), *Studies in Language and Literature in Honour of Margaret Schlauch, 195-201, Russell and Russell, New York.*

Laughren, M.: 1984, 'Tone in Zulu Nouns', in G. N. Clements and J. Goldsmith (eds.) *Autosegmental Studies in Bantu Tone*, 183-234, Foris, Dordrecht.

Leben, W.R.: 1971, 'Suprasegmental and Segmental Representation of Tone,' *Studies in African Linguistics*, Supp. 2, 183-200.

_____: 1973, *Suprasegmental Phonology*, Indiana University Linguistics Club, Bloomington.

_____: 1978, 'The Representation of Tone,' in V. Fromkin (ed.), *Tone: A Linguistic Survey*, 177-220, Academic Press, New York.

_____: 1980, *Suprasegmental Phonology*, Garland Press, New York.

Levin, J.: 1983, 'Reduplication and Prosodic Structure', unpub. ms., MIT, Cambridge.

Lindau, M.: 1974, 'The Feature Advanced Tongue Root,' in E. Voeltz (ed.), *The 3rd Annual Conference on African Linguistics April, 1972*, 127-33, Indiana University, Bloomington.

_____: 1979, 'The Feature Expanded' in the *Journal of Phonetics* **7**, 163-76.

Lyons, J.: 1971, *Introduction to Theoretical Linguistics*, Cambridge University Press, Cambridge.

McCarthy, J.: 1981, 'A Prosodic Theory of Nonconcatenative Morphology,' *Linguistic Inquiry* **12**, 373-418.

_____: 1982, 'Prosodic Templates, Morphemic Templates, and Morphemic Tiers,' in H. van der Hulst and N. Smith (eds.), *SPR* **1**, 191-224, Foris, Dordrecht.

_____: 1983, 'A Prosodic Account of Arabic Broken Plurals,' in *Current Approaches in African Languages and Linguistics*, **1**, 289-320, Foris, Dordrecht.

_____: 1986, 'OCP Effects: Gemination and Antigemination,' *Linguistic Inquiry*, **17**, 207-63.

Michaels, D.: 1987, 'Syllable Structure, Rules and Principles', In XIV International Congress of Linguists (CIPL),Berlin 10-15 August, 1987, Organized under the auspices of CIPL, Comite International Permanent des Linguistes, Berlin.

Mohanan, K.P.: 1982, *Lexical Phonology*, Ph.D. dissertation, MIT, Published by Indiana University Linguistics Club, Bloomington.

_____: 1985, 'Syllable Structure and Lexical Strata in English,' in C.J. Ewen and J.M. Anderson (eds.), *Phonology Yearbook* 2, 139-55, Cambridge University Press, Cambridge.

_____: 1986, *The Theory of Lexical Phonology*, Reidel, Dordrecht.

New International Version (NIV), *Holy Bible*, New York Bible Society. Hodder and Stoughton Ltd., Sevenoak, Kent.

Noske, R.: 1982, 'Syllabification in French,' in H. van der Hulst and N. Smith (eds.), *SPR* 2, 257-310, Foris, Dordrecht.

_____: 1987, 'Directional, Lexical and Postlexical Syllabification and Vowel Deletion,' in Proceedings of the XIth International Congress of Phonetic Sciences, Vol II. Tallinn, Academy of Sciences of the Estonian SSR.

Okoth-Okombo, D.: 1982, *Dholuo Morphophonemics in a Generative Framework*, V. Heine, W.J.G. Mohlig and F. Rottland (eds.), Deitrich Reimer Verlag, Berlin. Supp. 2.

Persson, A.: 1984, 'The Relationship of the Languages of the Sudan,' in R. Watson and W. Pace (eds.), *Occasional Papers in the Study of Sudanese Languages*, 3, 1-6, Summer Institute of Linguistics and the Institute for Regional Languages, Juba, Sudan.

Pesetsky, D.: 1979, 'Russian Morphology and Lexical Theory,' unpublished ms., MIT.

Pike, K.L.: 1947, *Phonemics*, University of Michigan Press, Ann Arbor.

Poser, W.J.: 1982, 'Phonological Representations and Action-at-a-Glance,' in H. van der Hulst and N. Smith (eds.) *SPR* 2, 121-58, Foris, Dordrecht.

Pulleyblank, D.: 1983, *Tone in Lexical Phonology*, Ph.D. dissertation, MIT.

_____: 1986, *Tone in Lexical Phonology*, Reidel, Dordrecht.

Reh, M.: 1986, 'Classification of Vowel Phonemes in Anywak,' *Afrikanistische Arbeitspapiere* 7, Schriftenreihe des Kolner Instituts fur Afrikanistik, 5-32.

The Rejaf Language Conference: 1928, Chaired by J. G. Matthew, O.B.E. Rejaf, Sudan.

Rubach, J.: 1985, 'Lexical Phonology: Lexical and Postlexical Derivations,' in C.J. Ewen and J.M. Anderson (eds.) *Phonology Yearbook* 2, 157-72, Cambridge University Press, Cambridge.

Schane, S.A.: 1973, *Generative Phonology*, Prentice-Hall Inc., Englewood Cliffs, NJ.

Schuh, R.G.: 1978, 'Tone Rules,' in V. Fromkin (ed.), *Tone: A Linguistic Survey*, 221-56, Academic Press, New York.

Selkirk, E.: 1982, 'The Syllable' in H. van der Hulst and N. Smith *SPR* 2, 337-84, Foris, Dordrecht.

Siegel, D.: 1974, *Topics in English Morphology*, Ph.D. dissertation, MIT, Published by Garland Press (1979), New York.

Sommerstein, A.H.: 1977, *Modern Phonology*, Edward Arnold, London.

Tucker, A.N.: 1955, 'The Verb in Shilluk,' *Mitt. des Instituts fur Orientforschung*, 421-62.

_____ and M.A. Bryan: 1966, *Linguistic Analyses of the Non-Bantu Languages of East Africa*, Oxford University Press, London.

Vago, R.M.(ed.): 1980, *Issues in Vowel Harmony*, Proceedings of the Cuny Linguistics Conference on Vowel Harmony, 14th May, 1977, John Benjamins B.V., Amsterdam.

van der Hulst, H.: 1985, 'Vowel Harmony in Hungarian: A Comparison of Segmental and Autosegmental Anaylses,' in H. van der Hulst and N. Smith (eds.) *Advances in Nonlinear Phonology*, 267-303, Foris, Dordrecht.

_____ and N. Smith (eds.): 1982, *The Structure of Phonological Representations (SPR)* **1,2**, Foris, Dordrecht.

_____ (eds.): 1985, *Advances in Nonlinear Phonology*, Foris, Dordrecht.

_____: 1985, 'The Framework of Nonlinear Generative Phonology,' in H. van der Hulst and N. Smith (eds.), *Advances in Nonlinear Phonology*, 3-58, Foris, Dordrecht.

Voeltz, E. (ed.): 1974, *The Third Annual Conference on African Linguistics*, April, 1972, Indiana University, Bloomington.

Watson, R. and W. Pace (eds.): 1984, *Occasional Papers in the Study of Sudanese Languages* **3**, Institute for Regional Languages, Juba, Sudan.

Wise, M.R. and R. Watson: 1985, *Occasional Papers in the Study of Sudanese Languages* **4**, Summer Institute of Linguistics, Juba, Sudan.

Westermann, D.: 1912, *The Shilluk People*, J.J. Augustin, Glückstadt.